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The Influence of Environment-Based Education on Students' Basic Psychological Needs and Academic Self-Regulation

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Dedication

This work is dedicated to all of my students, past, present, and future, who have inspired me to continually believe in the transformative power of education.

Abstract

Because of its relationship to perceptions of competence, learning, and achievement, as well as other affective outcomes, sustaining academic self-regulation is key to reversing the concerning trend of declining academic achievement in the United States. According to self-determination theory, satisfaction of three basic psychological needs (autonomy, competence, and relatedness) supports students' internalization and development of self-regulation. The current study uses this lens to investigate the influence of environment-based education on secondary students' basic psychological needs and academic self-regulation. While literature suggests that environment-based education uses pedagogy that would seem to foster satisfaction of the basic psychological needs (Lieberman, 2013), there is not yet research that examines self-determination theory in the context of environment-based education. Sixty-five students in grades six through twelve from five Midwestern U.S. high schools participated in the study. Data collection occurred during the 2018-2019 school year, with six months of existing environment-based education programs serving as the treatment. Students' scores on the *Academic Self-Regulation Questionnaire* (SRQ-A) and the *Need Satisfaction and Frustration Scale* (NSFS) assessed academic self-regulation and basic psychological needs, respectively. Data triangulation occurred through observations and student interviews. When controlling for age, gender, and prior participation, one-way repeated measures analyses of covariance (ANCOVAs) indicated no significant difference in pre- and post- test scores for academic self-regulation, need satisfaction, and need frustration. In light of the typical decline in children's academic self-regulation and need satisfaction,

these results support the use of environment-based education to sustain self-regulation. Potential impacts on research and program implementation are discussed.

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Chapter 1

Introduction

Background

On the 2015 Program for International Student Assessment (PISA), an international standardized test, the United States ranked 24th (reading), 25th (science), and 39th (math). The PISA test evaluates the level to which 15-year old students have mastered the essential knowledge and skills that are necessary for participation in modern society (Organisation for Economic Co-operation and Development, 2018). Governments and educators can use the results to evaluate the "quality, equity, and efficiency of school systems" and identify effective policies for further adaptation and application within their local school and community contexts (PISA, 2015, p. 3). These results reflect a continued decrease in performance of US students on international tests and have resulted in increased concern over students' abilities to compete on an international level.

In addition to U.S. students' limited success on these standardized tests, students often graduate high school and college without full development of noncognitive skills. Noncognitive skills include academic behavior, perseverance, mindset, learning strategies, and skills which are needed to succeed in civil society (Farrington et al., 2012). Even after completing study at a university, many graduates cited a lack of development in their ability to frame and ask questions. These same graduates also identified a need to further develop their interpersonal communication and delegation skills. Both of these tasks are real world skills that are vital for both personal and career success (Head, 2016).

Coupled with these low levels of measured cognitive and noncognitive skills, research has shown a concerning decline in children's academic intrinsic motivation and their ability to self-regulate from elementary to high school years (Harter, 1981a; Gottfried, Fleming, Gottfried, 2001; Gottfried, Marcoulides, Gottfried, & Oliver, 2009; Lepper, Corpus, Iyengar, 2005). Higher levels of intrinsic motivation are positively related to perceptions of competence, learning, and achievement (Bailey & Phillips, 2015), as well as affective outcomes such as lower stress and greater self-esteem and subjective well-being (Bailey & Phillips, 2015; Petersen, Louw, & Dumont, 2009). Although noncognitive skills are often related to academic performance, there is unclear evidence about the implications these may have on educational practice (Farrington et al., 2012). Therefore, a better understanding of motivation, what drives it, and how it impacts students' skill development may help to provide evidence of effective educational practice.

Based on the motivational research surrounding self-determination theory (SDT), when individuals have the ability to take external values and contingencies and transform these into personal values and self-motivations, they demonstrate increased self-regulation and are said to be self-determined (Ryan & Deci, 2000; Ryan & Deci, 2006). Many studies have shown that these factors are key components for personality development, well-being, and academic achievement (e.g., Il-haam, Peterson, & Louw, 2009; Ryan & Connell, 1989; Ryan & Deci, 2000; Williams & Deci, 1996). Although self-determination theory assumes that individuals have an intrinsic desire to be curious, self-motivated, and assimilated to the knowledge that surrounds them, this theory also

recognizes that in order for self-determination to occur, three psychological needs must be met: autonomy, competence, and relatedness. When social contexts are not responsive to these needs, individuals cannot appropriately experience psychological growth and well-being (Deci & Ryan, 2000). In classrooms where external controls, close supervision and monitoring, and large amounts of evaluative pressure dictate the learning environment, feelings of anxiety, boredom, and alienation often replace the intrinsic joy, enthusiasm, and interest an individual is born with (Garn, Morin, & Lonsdale, 2019; Niemiec & Ryan, 2009; Rogers & Tannock, 2014; Tian, Chen, Huebner; 2014;). Numerous studies have identified a decrease in self-determined motivation as well as satisfaction of basic psychological needs as students progress from primary to secondary school (Gnambs & Hanfstingl, 2015; Navarro-Patón, Lago-Ballesteros, & Basanta-Camiño, Arufe, 2018; Otis, Grouzet, & Pelletier, 2005;). These documented declines may offer a better understanding of the classroom contexts that are impacting the development of students' cognitive and noncognitive skills. However, it is difficult to change classroom practice without research based in real classrooms with real strategies (Farrington et al., 2012). Therefore, this study will look at one pedagogical approach, environment-based education, through the lens of self-determination theory with the intent of identifying impacts and implications of such practice.

Environment-based education, with its interdisciplinary use of skills and its focus on experiential learning, offers a pathway to meet these psychological needs and to elicit and sustain academic self-regulation and intrinsic motivation. In 1996, Linda Hoody made the astute observation that, "Perhaps, capitalizing on a child's intrinsic interest in

the natural world and actively engaging that child in the educational process would create an enthusiastic learner for a lifetime" (p. 19). From a similar perspective, Richard Louv wrote, "An environment-based education movement-at all levels of education-will help students realize that school isn't supposed to be a polite form of incarceration, but a portal to the wider world" (2005, p.226). Environment-based education offers students a plethora of opportunities to apply skills in real-world learning contexts that relate to their individual interests, develop essential skills, and help to improve the community. Learning in this way helps students apply the skills they learn in class and build their competence while they improve their own communities (Hungerford & Volk, 1990; Lieberman & Hoody, 1998).

In his book *Education and the Environment*, Gerald Lieberman outlined the key objectives of an environment-based education program (2013, p.44):

1. Teaching academic content standards;
2. Understanding of natural and human social systems and their interactions;
3. Ability to investigate real-world issues and related decision-making processes;
4. Participation in service-learning activities to encourage active involvement in a civil society;
5. Skills needed to identify and resolve environmental issues;
6. Reinforcement of communication skills;
7. Preparation of students for college and/or careers.

In this same text, Lieberman (2013) writes, "While environment-based education is not a magic bullet that will solve all of the world's problems, the benefits it has to offer are

worth considering at this important time" (p. 7). Current environment-based education research supports this statement and has highlighted some of these benefits including the instructional framework's positive correlation with academic achievement, attendance, and critical thinking (Athman & Monroe, 2004; Ernst & Monroe, 2004; Falco, 2004). Although these are all important outcomes, it is also imperative for schools to foster the innate curiosity that lives inside a child. Without sustained curiosity and self-regulation to pursue learning, students may struggle to adjust and perform in new settings and to acquire new knowledge, skills, and a high-level of expertise (Hoffman et al., 2014; Il-haam et al., 2009;).

The holistic nature of environment-based education offers a possible pathway to not only improving academic achievement, but also leading students to develop more internalized self-regulation and intrinsic motivation through fulfillment of the psychological needs of autonomy, competence, and relatedness. Theoretically, environment-based education includes many of the research-based practices to meet students' psychological needs and prevent the decline in intrinsic motivation. Therefore, this study used the lens of self-determination theory to examine environment-based education's impacts on students' academic self-regulation as well as the degree to which the basic psychological needs are satisfied or frustrated in the context of the school learning environment.

Purpose Statement

In light of the typical decline in academic self-regulation and satisfaction of basic psychological needs in secondary students, does participation in environment-based

education help to sustain these key components of self-determination? This research purpose was explored in the context of the following research questions:

Research Questions

1. Does environment-based education influence secondary students' need satisfaction and need frustration in academic autonomy, perceived competence for learning, and relatedness in school, when controlling for age, prior participation and gender?
2. Does environment-based education influence academic self-regulation in secondary students, when controlling for age, prior participation, and gender?
3. What characteristics of environment-based education influence academic self-regulation, academic autonomy, perceived competence for learning, and relatedness in school?

Definition of Terms

Using the guidelines for definitions of terms as outlined by Creswell (2014), this section provides a nominal definition for each key term used throughout this study. When relevant, an operationalized definition as well as the instrument used for observable measurement is provided.

Environment-based education.

Environment-based education is a framework for instruction that focuses on standards-based education results by using the environment and related issues as a context for instruction (Lieberman & Hoody, 1998). A rubric based on the key pedagogies and objectives of environment-based education was used to ensure

participating schools met the definition (Lieberman, Lieberman, & Hoody, 2002). This rubric will be described in greater detail in Chapter 3 and is included in Appendix C.

Academic intrinsic motivation.

Academic intrinsic motivation is enjoyment of school learning characterized by a mastery orientation, curiosity, persistence, task endogeny, and the learning of challenging, difficult, and novel tasks (Gottfried, 1985, 1990). In order for students to develop academic intrinsic motivation, they must also develop internalized forms of self-regulation and have their needs for autonomy, competence, and relatedness met (Deci & Ryan, 1985, 2000; Ryan & Deci, 2002). As shown in Figure 1, when students' basic needs of autonomy, relatedness, and competence are supported, they are more likely to develop and exhibit academic intrinsic motivation. Because it is not realistic to expect that students will become intrinsically motivated about all subjects in school, this study measured self-regulation (defined below), rather than intrinsic motivation, which offered a more nuanced understanding of motivation. However, because intrinsic motivation is

closely tied to self-regulation, an understanding of academic intrinsic motivation was a key foundation for this study.

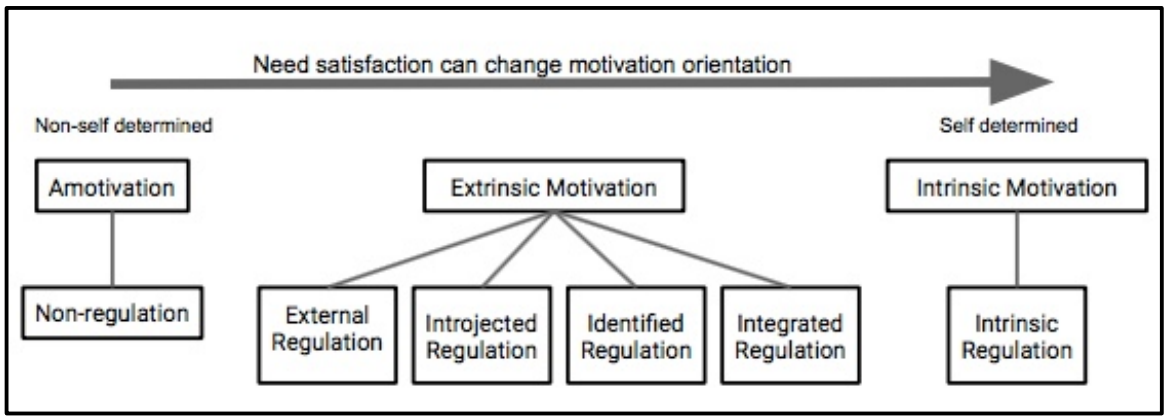

Figure 1. Supporting autonomy, relatedness, and competence can change students' motivation orientation (Adapted from Trenshaw, Revelo, Earl, & Herman, 2016; Ryan & Deci, 2000)

Academic self-regulation

Self-regulation concerns how individuals take in social values and extrinsic contingencies and progressively transform them into personal values and self-motivations (Ryan & Deci, 2000). Along the continuum of regulation, (see Figure 1), an individual can range from heteronomy (controlled regulation) to full autonomy (self-regulation) (Ryan & Deci, 2000; 2006). In order to determine a student's relative level of autonomy, this study examined the degree to which he or she self-regulated in an academic setting, specifically referred to as academic self-regulation. For the purpose of this study, academic self-regulation was measured by the Academic Self-Regulation Questionnaire (SRQ-A; Ryan & Connell, 1989).

Basic psychological needs

Basic Psychological Needs Theory (Deci & Ryan, 1985, 2000; Ryan & Deci, 2002), a mini theory of SDT, posits that the satisfaction of three basic psychological needs (autonomy, competence, and relatedness) supports students' internalization and development of self-regulation and intrinsic motivation. An individual may feel as though their needs are met in one setting (i.e., school) but not another (i.e., family life). Therefore, this study examined each of the psychological needs in the context of the school learning environment. Each psychological need is further described and operationalized below. For the purpose of this study, all three were measured through the Need Satisfaction and Frustration Scale (NSFS; Longo, Gunz, Curtis, & Farsides, 2014)

Academic autonomy.

Academic autonomy refers to the individual's desire to integrate and self-organize academic experiences and behavior (Deci & Ryan, 2000; Niemiec & Ryan, 2009; Hoffman et al., 2014). An individual can range from heteronomy (controlled regulation) to full autonomy (self-regulation; Ryan & Deci, 2006).

Perceived competence for learning.

Perceived competence is the feeling that one can effectively interact with the environment and can enact a certain task (Deci, Schwartz, Sheinman, & Ryan, 1981; Harter, 1982; Niemiec & Ryan, 2009; Williams & Deci, 1996). This study focused on perceived competence for learning or the feeling that one can effectively interact with the academic environment and can enact an academic task.

Relatedness within the school context.

Relatedness refers to the desire to feel connected to others, to love and care, to be

loved and cared for, and to have a sense of 'belongingness' with other individuals and with one's communities (Ryan & Deci, 2002). For the purpose of this study, relatedness was measured through students' perceptions of their connectedness and belongingness within the school community and will be herein referred to as "relatedness in school."

Significance

Self-determination theory posits that the satisfaction of three basic psychological needs (autonomy, competence, and relatedness) supports students' internalization of values and the development of both self-regulation and intrinsic motivation. Various studies explore the importance of satisfying these needs and some suggest general instructional practices that may improve need satisfaction. However, few studies have approached the topic through the lens of a specific educational philosophy's effect on the three constructs. Even when research shows that various factors are related to academic performance, that does not mean that educators and lawmakers are equipped to do anything to leverage the changes needed. It is difficult to change classrooms on a broad scale without research based in actual classrooms with the goal of helping teachers develop and acquire new strategies (Farrington et al., 2012). Therefore, this study aimed to quantify the beneficial effects of environment-based education on students' academic self-regulation and basic psychological needs while also offering a more in-depth analysis on the factors of environment-based education that may have contributed to these improvements. If the data show yet another benefit of environment-based education, then they further strengthen the importance of including environmental

education within the walls of traditional secondary schooling, while also offering further examples of how to meet the various needs of secondary students.

Chapter 2

Review of Literature

The Educational Landscape: Testing and External Motivation

At both the international and national level, U.S. students struggle with standardized tests. Since its inception in 1992, 12th grade reading scores on the National Assessment of Educational Progress (NAEP) have decreased. In 2015, only 37% of 12th grade students scored at or above the *Proficient* level in reading, and 24% of 12th grade students scored below the *Basic* level, which demonstrates a lack of even partial mastery of fundamental reading skills. The 2015 NAEP mathematics scores show even lower rates of proficiency. Thirty-eight percent of 12th graders scored below the *Basic* level, 62% scored at or above the *Basic* level, and 25% scored at the level of *Proficient* or above (McFarland et al., 2017).

In 2014, 8th grade students across the country also took the NAEP's Technology and Engineering Literacy assessment. This new assessment measures students' ability to apply technology and engineering skills to real-life situations in three content areas: Technology and Society, Design and Systems, and Information and Communication. Forty-three percent of students scored at the level of *Proficient* or above, 40% scored at or above the *Basic* level, and 17% scored below the *Basic* level (McFarland et al., 2017). This assessment also included a questionnaire to gather information regarding students' learning experiences in and out of school in these three content areas. Only 28 percent of students reported "often learning about or discussing in school the ways people work together to solve problems in their community or the world" (McFarland et al., 2017,

p.185). Thirty-seven percent reported figuring out why something was not working in order to fix it more than five times outside of school as opposed to only 18% reporting performing these actions in school. Furthermore, 30% reported taking something apart in order to see how it works more than five times outside of school as compared to only 12% who reported doing so in school (McFarland et al., 2017). The discrepancies in these data point to just one example of the incongruent nature of students' interests and their school tasks and learning. These differences also highlight the lack of hands-on problem solving and development of skills that can be used outside of the classroom.

Amidst this declining academic performance, external controls and motivation often serve as the driving factor in today's classrooms. Developed from Skinner's theories of operational conditioning (1953), school systems rely heavily on reinforcing learning and achievement through varying external methods. Skinner tested the effect of reward and punishment on developing feedback and impacting future behaviors. In his publications, he emphasized the importance of reinforcement for learning and development of new behaviors. He argued that by adding or removing stimuli, individuals would learn to change their behavior in order to either continue receiving or to avoid the stimuli. From this work, learning is seen as a process of conditioning rather than as an inherent tendency (Skinner, 1953). Based on Skinner's research, educators often strive to motivate student through varying forms of rewards and punishments, such as stickers for homework completion, banning students from recess for misbehavior or offering days off of school for earning high test scores. As students progress through school, and the stakes for high performance increase, external controls such as grades,

evaluations accompanied by reward or punishment, and close supervision and monitoring increase. Additionally, in response to the aforementioned declines in student performance, legislators increasingly call for more accountability, more measures of success, and essentially, more testing. These external controls, intended to increase motivation and accountability, instead may be yet another factor that contributes to poor performance, rather than correcting it (Deci & Ryan, 2002).

Extrinsic motivation has been shown to correlate negatively with academic achievement, intrinsic motivation, and feelings of autonomy while correlating positively with increased feelings of anxiety, boredom, and alienation (Deci & Ryan, 1985, 1987, 2002; Lepper et al., 2005). Ryan and Connell (1989) identified an inverse relationship between external regulation and interest, value, and effort towards achievement. Furthermore, students who were more externally regulated for their academic behaviors tended to shift responsibility for negative outcomes from self to others. By assigning accountability to others, students externalize their locus of control and do not see the connection between their behaviors and the outcome. Without a high sense of control for a situation, individuals feel less able and less willing to make changes to remedy the situation (DeCastell & Byrne, 2015; Deci & Ryan, 1985).

One explanation for these correlations may be that in response to an increased push for accountability, the classroom often shifts from a place of learning for the joy and skill of gaining knowledge to a place of learning to pass a test (Grolnick & Ryan, 1987; Louv, 2005; Niemiec & Ryan, 2009). Rather than feeling joy and enthusiasm directed towards learning, students are instead filled with dread at the prospect of taking another

test. Furthermore, in direct contrast to the view that one goal of school is for students to regulate and motivate themselves, external rewards may undermine the long-term development of intrinsic motivation (Deci, 1971). Instead of developing personal reasons for learning and working hard, students become reliant on the external reward of candy, grades, or some other stimuli. When those rewards are removed, then the students may lose interest in the learning.

Learning and Intrinsic Motivation

In contrast to the highly controlled and regulated view of learning previously described, another view of learning describes it as a life-long process that occurs everywhere from the museum, to falling out of a tree, to engaging in a new conversation. It occurs when an individual makes contact with and assimilates the environment into one's self. In its truest form, it is natural, spontaneous, and intrinsic to the individual (Rigby, Deci, Patrick, & Ryan, 1992). In its purest form, learning is intrinsically motivated. In other words, it is done in the absence of external impetus and is inherently interesting and enjoyable (Deci, 1975; Deci & Ryan, 2000). In the realm of academics, this type of intrinsic motivation is characterized by enjoyment of school learning, curiosity, persistence, task endogeny, mastery orientation, and the learning of challenging, difficult, and novel tasks (Gottfried, 1985, 1990).

However, as previously described, students encounter increasing external demands as they progress through the U.S. educational system. Furthermore, they are almost guaranteed to encounter times in which the required subjects are not inherently interesting. Not surprisingly then, academic intrinsic motivation tends to decline as

students progress from elementary school on to middle and high school (Gottfried et al., 2001; Gottfried et al., 2009; Harter, 1981a; Lepper et al., 2005). This decline occurs most drastically in the transition years from late middle school to high school (Corpus, McClintic-Gilbert, & Hayenga, 2009; Gottfried, 2001). However, research has shown that academic intrinsic motivation is a time stable construct, which indicates that the declines seen throughout adolescence are neither developmental nor inevitable (Gottfried et al., 2001). Therefore, this leaves researchers and educators with a large gap of knowledge in understanding why intrinsic motivation declines and how this decline can be stopped. Some of the many factors that have been hypothesized to contribute to the decline in academic intrinsic motivation include:

- A poor fit between children's developmental needs and the school environment (Eccles et al., 1993);
- Low amount of challenge in the curriculum (Schunk et al., 2014);
- Low amount of relevance between the curriculum and the students' lives (Brown & Campione, 1998);
- Lower self-efficacy for success in school (Schunk et al., 2014);
- Imposing external constraints on children's learning (Deci & Ryan, 1985);
- Shift of goal orientation to emphasize performance goals rather than mastery goals (Dweck, 1999);
- An increase in rewards for the products of academic effort rather than for an intrinsic interest in learning (Harter, 1992).

INFLUENCE OF ENVIRONMENT-BASED EDUCATION

Understanding the factors that influence academic intrinsic motivation are of great interest to both researchers and educators. Although students can learn for both extrinsic and intrinsic reasons, learning for intrinsic reasons is more enjoyable and also relates positively to perceptions of competence and negatively to anxiety (Gottfried, 1985, 1990; Lepper et al., 2005). Studies have also shown positive correlations between intrinsic motivation and academic achievement (Gottfried 1985, 1990; Harter & Connell, 1984; Henderlong & Lepper, 1997) which may suggest that a decrease in intrinsic motivation correlates with a decrease in academic achievement. Furthermore, intrinsically motivated students tend to engage in activities that enhance learning and initiate a spark of interest beyond a single activity or investigation. For example, Becker, McElvany, and Kortenbtuck (2010) conducted a longitudinal study of fourth-grade students' intrinsic motivation for reading and actual reading skills two years later in sixth grade. They found a positive correlation between the two constructs, suggesting that the intrinsically motivated students may read more frequently, thus improving their reading skills.

While the aforementioned research points to the importance of intrinsic motivation, and highlights some of the negative implications of extrinsic motivation, the conclusion should not be drawn that the end goal of education is to produce students who are only intrinsically motivated. First, a student who is only motivated to engage in activities that are of inherent interest may miss out on opportunities for learning and growth and perhaps hinder future outcomes and success. When used correctly, extrinsic goals and motivation may help students stay on task and set long-term goals (Deci & Ryan, 2000). For example, a college student working towards becoming a doctor may

not have an inherent love for Organic Chemistry, but the student will still work hard in order to achieve their long-term career goal.

Second, extrinsic and intrinsic motivation are not opposing ends of a unidimensional scale, with little room for any interpretation between the two ends. In the 1980's, Susan Harter's research provided much insight into students' motivation and she identified a strong decline in students' intrinsic motivation from third through eighth grade (1981a). Her scales asked students to identify the reasons for their activity and allowed them to choose between only extrinsic and intrinsic motivations. This limitation led others to test the correlation between extrinsic and intrinsic motivation when studied as separate constructs. Results of this study demonstrated only a minor correlation, suggesting that extrinsic and intrinsic motivation are independent of one another (Lepper et al., 2005). Within any scenario, an individual may experience low levels of both intrinsic and extrinsic motivation, high levels of one and low levels of the other, medium levels of both, and so forth. Rather than thinking of extrinsic and intrinsic motivation as opposite ends of a continuum, a more accurate picture puts each on its own individual continuum (Rigby et al., 1992).

Finally, both intrinsic motivation and extrinsic motivation depend upon time and context (Ryan & Deci, 2000). Student A, B, and C may experience the same learning scenarios, but feel motivated for different reasons. For example, given a reading passage about the Civil War, Student A chooses to engage in the passage because of an inherent interest in the time period. Student B chooses to read the passage in order to perform well on the upcoming exam. Student C reads the passage intently because of both an

interest in the subject and a desire to perform well on the exam. In a different scenario, for example in math class, each student may choose to complete their work for vastly different reasons.

While many researchers continue to analyze motivation through the lens of intrinsic or extrinsic motivational styles, this unidimensional view does not give a full picture of the spectrum of motivation. Additionally, because motivation is contextual, it changes over time and requires a more nuanced understanding. An alternative view, through the lens of self-determination theory, offers a more detailed examination of motivation as a regulated, multidimensional concept which varies in terms of quality (Deci & Ryan, 1985, 2000; Ryan & Deci, 2000).

Self-Determination Theory

Self-determination theory proposes that individuals have evolved tendencies to be curious and interested in their surroundings and that they strive to find coherence in their knowledge. Although individuals have "inherent growth tendencies and innate psychological needs" (Ryan & Deci, 2002, p. 68), social contexts play a vital role in the difference between an inspired or crushed human spirit. Various cultural aspects, environments, and interpersonal interactions impact an individual's level of self-determination. Development of self-determination also plays a critical role in facilitating the development of intrinsic motivation, social development, and well-being (Ryan & Deci, 2002).

Similar to other motivational theories, self-determination theory highlights the benefits of intrinsic motivation, or behaviors done in the absence of external impetus that

are inherently interesting and enjoyable (Deci, 1975; Deci & Ryan, 2000). However, intrinsic motivation will only occur in activities for which an individual has an inherent interest (Ryan & Deci, 2000). Therefore, in contrast to other theories of motivation, self-determination theory expands upon the extrinsic-intrinsic motivational dichotomy and focuses on internalization and self-regulation as tools through which social values and extrinsic contingencies can be progressively transformed into personal values and self-motivations (Ryan & Deci, 2000). Through the lens of self-determination theory, motivation is a malleable construct which changes through the process of integrating external contexts and constraints. Internalization is the "process by which an individual initially acquires beliefs, attitudes, or behavioral regulations from external sources and progressively transforms these external regulations into personal attributes, values, or regulatory styles" (Ryan, Connell, & Grolnick, 1992, p. 171). In other words, external regulations are transformed into internal regulations. Therefore, through this process, externally controlled behavior can become autonomous.

The self-determination continuum displays the six styles of regulation and addresses the relative autonomy of each (see Figure 2; Rigby et al., 1992; Ryan & Deci, 2000).

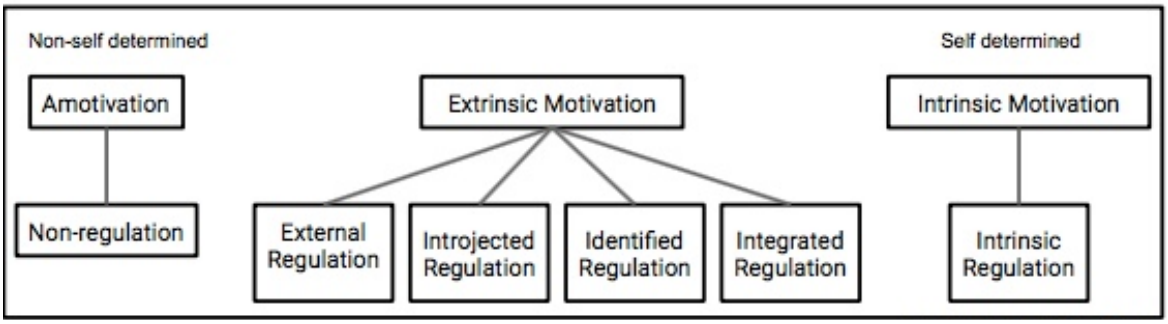

Figure 2. The self-determination continuum (Adapted from Ryan & Deci, 2000)

The continuum begins on the left side with *amotivation*, or the state of an individual who does not act or acts without any intent. The next section displays the four regulatory styles that fall within extrinsic motivation. Each of these regulatory styles results from varying levels of internalization and autonomous self-regulation. As an individual's regulation shifts from external to integrated, it also signifies a shift towards greater autonomy.

The first, *external regulation*, explains behaviors that are regulated by an external demand. Classroom teachers often offer rewards such as stickers and prizes for students who complete homework or demonstrate good behavior. A child who responds to these rewards and completes his or her homework in order to receive the prize then demonstrates external regulation. The child is driven to complete the work because of this external factor rather than because he or she inherently enjoy the activity.

Introjected regulation describes behaviors that are motivated by avoidance of guilt or anxiety or to improve self-esteem. These behaviors are typically completed because an individual feels like it is the right thing to do; however, he or she has not integrated the behavior into his or her self-identity. Students may exhibit introjected

regulation when they study hard to earn a good grade and make their parents proud. These students do not need physical prizes from their parents to study; however, they are not studying to meet their own personal goals.

Identified regulation occurs when an individual identifies the value of the activity and accepts that action as personally important. Students may exhibit identified regulation by participating in class activities because they value the learning that will occur through the planned lesson. In this example, the students have not engaged because they are inherently interested (intrinsic motivation) nor because they are offered a reward or praise (external and introjected motivation) (Deci & Ryan, 2002).

Integrated regulation, the most autonomous form of external motivation, occurs when an individual fully internalizes the regulation of an activity and it is brought into congruence with his or her values and needs. The regulation of the activity emanates from the self; however, the activity itself is still done for an external reason rather than for inherent enjoyment. For example, a law student may not find every class enjoyable; however, the individual will study with a full sense of volition because he or she values the learning as an instrumental step in becoming a lawyer. The learning is not inherently interesting (intrinsic motivation); however, the student willingly studies in order to achieve a goal that is fully assimilated into his or her sense of self. Integration requires mature cognitive capacities and therefore is typically not developed until late adolescence (Deci & Ryan, 2002).

Finally, a student may possess *intrinsic motivation* for a subject or learning activity. This student engages in a learning task due to an inherent interest in the task or

subject. For example, a child who is fascinated by birds may choose to read field guides, participate in bird hikes, and observe birds during free time. If this student is assigned a project to record daily observations of birds in a field journal, he or she will likely do so with great enthusiasm. While this engagement represents a joy in learning that most educators strive to instill in their student, it cannot be assumed, or even expected, that a student will have such interest for every learning activity encountered. In these cases, extrinsic motivation drives the completion of a task. Therefore, it is of great importance to educators to understand the importance of self-regulation and internalization.

In the context of education, internalization is especially noteworthy because it helps the individual learn to self-regulate behaviors that are not intrinsically motivating (Ryan et al., 1992). The development of self-regulation for learning helps the student separate from external pressures and instead focus on developing an inner value for the process of learning (Ryan et al., 1992). Additionally, students who are academically self-regulated will willingly devote more time and energy to completing their school work (Niemiec & Ryan, 2009). Higher levels of self-regulation are correlated with benefits similar to those of higher levels of intrinsic motivation such as higher quality learning (Grolnick & Ryan, 1987), enjoyment of school and ability to cope with failures (Grolnick & Ryan, 1989), self-reports of trying hard in school (Ryan & Connell, 1989) and higher teacher ratings of student competence (Grolnick, Ryan, & Deci, 1991). Conversely, a decrease in self-determined motivation is associated with less long-term educational adjustment during the senior high school transition as well as a higher level of absenteeism (Otis, Grouzet, & Pelletier, 2005).

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Similar to the patterns seen in academic intrinsic motivation, additional research has identified a decline in self-determined motivation across a student's academic career (Gnambs & Hanfstingl, 2015; Otis et al., 2005). The process of internalization cannot be forced and an individual may not be able to fully internalize all behavioral regulations, specifically those that conflict with basic needs. Internalization will only occur through conscious volition when the basic psychological needs of autonomy, competence and relatedness are met (Ryan and Deci, 2000). Therefore, part of the decline in intrinsic motivation and self-regulation may be attributed to a decline in need satisfaction that occurs as students progress through school (Gnambs & Hanfstingl, 2015; Jacobs, Lanza, Osgood, Eccles, & Wigfield, 2002; LaGuardia & Ryan, 2004).

Basic Psychological Needs

According to Basic Psychological Needs Theory, a sub-theory of self-determination theory, all individuals have three basic psychological needs which must be satisfied in order to achieve optimal well-being and self-regulation (Deci & Ryan, 2000). These three needs of autonomy, competence, and relatedness are universal and spread across cultures (Deci & Ryan, 2000; Hayamizu, 1997; Schmuck, Kasser, & Ryan, 2000). Especially relevant in the context of education, when basic needs are satisfied intrinsic motivation remains relatively stable (Gnambs & Hanfstingl, 2015). Additional studies have linked satisfaction of competence to identified regulation (Vallerand, Blais, Briére, & Pelletier, 1989) and have shown that students are typically more self-determined when parents are involved and autonomy supportive (Grolnick & Ryan, 1989).

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Basic needs satisfaction also predicts school related subjective well-being (Tian et al., 2014), academic achievement (Badri et al., 2014), and prosocial behavior (Tian et al., 2018). Conversely, need frustration predicts classroom maladaptations such as disengagement (Earl, Taylor, Meijen, & Passfield, 2017) and antisocial behavior (Tian et al., 2018). Furthermore, when the social context supports need satisfaction, through actions such as providing meaningful rationale for an activity, acknowledging individuals' feelings, and conveying a sense of choice, individuals are more likely to demonstrate integrated self-regulation. In contrast, when contexts are not supportive of these needs individuals are more likely to demonstrate introjected self-regulation (Deci et al., 1994).

It is important to note that frustration of a need is not equivalent to low satisfaction of that need (Longo et al., 2014; Longo, Alcarez-Ibanez, & Alvaro, 2018). Need frustration occurs when an individual's basic needs are undermined in a given context. Therefore, the satisfaction and frustration of psychological needs are separate constructs and contribute to well-being and ill-being respectively (Chen et al., 2014; Longo et al., 2018). Need satisfaction best predicts positive outcomes such as sustained intrinsic motivation whereas need frustration subscales better predict negative outcomes such as depression and anxiety (Longo et al., 2014). Furthermore, while low satisfaction of needs can impede individual growth and development, a growing body of research suggests that need frustration may be equally, if not more, harmful (Bartholomew, Ntoumanis, Ryan, Bosch, & Thøgersen-Ntoumani, 2011). For example, a student may feel less relatedness to other students and teachers at school and therefore have less

excitement for school work. Alternatively, a student could also be actively excluded, rejected, or ridiculed by peers or teachers and may develop severe symptoms of stress or depression.

Like intrinsic motivation and self-regulation, satisfaction of the basic psychological needs has shown to decrease as students progress from primary to secondary education (Gnambs & Hanfstingl, 2015; Navarro-Patón et al., 2018). This decrease in need satisfaction has been linked to a corresponding decrease in intrinsic motivation (Gnambs & Hanfstingl, 2015). However, the link between need satisfaction and other forms of self-regulation, as well as longitudinal research examining the impact of school on need frustration, remains largely unstudied.

When classrooms maximize student autonomy, build competence, and offer social supports to meet the need for relatedness, students are more likely to internalize the external controls in their learning environment (Niemiec & Ryan, 2009; Ryan et al., 1992). However, there isn't one clear path as to how to best satisfy needs and avoid need frustration. While multiple studies have revealed a lack of significant differences between sex or ethnicity and intrinsic motivation, cultural and gender differences may impact both what constitutes intrinsic and extrinsic motivation as well as the best strategies for helping individuals develop a more self-regulated style of motivation (Gottfried 1985, 1990; Gottfried et al., 2001; Lepper, 2005). Variability in cultural values and goals also suggests that the methods of satisfying basic needs may vary across cultures (Deci & Ryan, 2000). This distinction may be especially salient for cultures that emphasize collectivism over individualism. Therefore, the following discussion will

dissect each psychological need in the context of the classroom, identify relevant cultural and societal nuances, and discuss some of the possible implication for classroom application.

Developing Academic Autonomy

Academic autonomy refers to the individual's desire to integrate and self-organize academic experiences and behaviors (Deci & Ryan, 2000; Niemiec & Ryan, 2009; Ryan & Connell, 1989). An individual can range from heteronomy (controlled regulation) to full autonomy (self-regulation; Ryan & Deci, 2006). Self-determination theory emphasizes the importance of cultivating autonomy in order to sustain intrinsic motivation. Even when individuals have the same level of perceived competence, those with more internal regulation have more interest, excitement, and confidence and therefore have enhanced performance, persistence, and creativity (Ryan & Deci, 2000). A greater sense of autonomy is also associated with greater motivation and adjustment (Ryan, Connell, & Deci, 1985). Additionally, the satisfaction of autonomy predicts long-term interest orientation later in life, which is an indicator of sustained intrinsic motivation (Krapp, 2005). Fostering feelings of autonomy not only aids in sustaining intrinsic motivation but also helps to facilitate movement towards more integrated and internalized regulations when the behavior is not inherently motivating to the student (Williams & Deci, 1996).

Teacher support of autonomy serves as an important mediator on the decline in intrinsic motivation (Gillet, Vallerand, & Lafrenière, 2012). Therefore, it is essential that teachers know how to support students through actions such as minimizing evaluative

pressures and maximizing student's perceptions of voice and choice (Deci, Egrhari, Patrick & Leone, 1994). Learning experiences must be personally relevant to the student in order to aid in the internalization process (Ryan et al., 1992). Therefore, when introducing learning tasks, especially those that may be inherently uninteresting, teachers should include a rationale for why the learning activity is useful (Niemiec & Ryan, 2009). Meaningful rationale for uninteresting behavior can also help to promote internalization and integration (Deci et al., 1994; Ryan & Deci, 2000). Furthermore, creating options for choice, perspective, and individuality helps to foster feelings of autonomy and thus, integration and internalization (Deci et al., 1994; Garn, Morin, & Lonsdale, 2019). These options should be offered in the context of firm and consistent structure, where students understand the expectations but also feel free to generate their own opinions and decisions (Ryan & Grolnick, 1986).

These guidelines can also be applied to the way in which administrators create guidelines to facilitate school rules and culture. When pressured by superiors to meet performance standards or teach in a specific way, teachers lectured more often and gave students fewer opportunities for choice (Deci, Spiegel, Ryan, Koestner, & Kauffman, 1982). Students who experience pressure-oriented language and high levels of control feel less autonomy (Garn et al., 2019). Not only does a controlling setting impact students' autonomy, it also impacts teachers' well-being and motivation (Cuevas, Ntoumanis, Fernandez-Bustos, & Bartholomew, 2018). This is not to say that high expectations for teachers or students automatically result in less autonomy, but rather that when systems are controlling, teachers respond by increasing the control in their

classroom, which in turn impacts autonomy and self-regulation (Deci et al, 1982; Gnambs & Hanfstingl, 2015).

Although some research has showed that the basic-psychological needs are universal (Deci & Ryan, 2000; Hayamizu, 1997; Schmuck et al., 2000), questions have surfaced concerning the efficacy of autonomy in a collectivist society. A meta-analysis comparing the general need for autonomy between the United States (individualist culture) and East Asia (collectivist culture) showed a correlation between autonomy and well-being for both cultures (Yu, Levesque-Bristol, Maeda, 2018). These findings support the claim that autonomy is a universal need; however, it may be satisfied through different methods. For children of Asian descent, where cultural values typically stress collectivism, pleasing others may not conflict with an individual's desire to seek challenges, foster curiosity, and desire mastery (Iyengar & Lepper, 1999; Lepper et al., 2005). One study compared the effects of intrinsic motivation for Americans and Asians (Iyengar & Lepper, 1999). In the American sample, individual decisions correlated to the highest levels of intrinsic motivation. Conversely, in the Asian sample, accepting decisions made by a trusted individual correlated with the highest levels of intrinsic motivation. These results suggest that in individualist cultures, autonomy is expressed through making one's own decisions whereas in collectivist cultures, autonomy may be expressed by making decisions that are consistent with cultural values. Further data suggest that students of Asian descent may view parents and teachers as part of a helpful and necessary support system rather than controlling external constraints (Lepper et al., 2005). It is important to note that variability exists within all cultures; therefore, both

researchers and educators need to look more closely at contextual variations before making assumptions about any group (Zusho & Clayton, 2011).

Building Competence in the Classroom

Perceived competence signifies self-perception of an individual's own ability to effectively enact a behavior (Niemiec & Ryan, 2009). It is a context dependent construct which may change through time and setting. Students may experience high levels of perceived competence when learning a new task and then mastering the presented challenge. On the other hand, students may feel low levels of perceived competence when they continually struggle to master a skill or subject. Because students will only engage in activities in which they feel competent to understand and master the material, educators must help students test and expand their academic capabilities through optimally challenging learning activities and constructive feedback (Niemiec & Ryan, 2009). Additionally, a longitudinal study showed that declines in feelings of competence correlated with declines in subject-specific school interests (Jacobs et al., 2002). Conversely, satisfaction of competence needs may predict sustained intrinsic motivation in a subject later in life (Krapp, 2005).

Designing tasks with the optimal level of challenge, not so much that students cannot succeed but not so little that they quickly and easily complete the work, builds perceived competence (Ryan et al., 1992). If the work is too easy, the students will grow bored, will learn to avoid challenges, and will plateau in their learning. On the other hand, if the work is too hard, students may abandon their efforts, grow discouraged, and lose interest in the topic (Dweck, 2006). This intermediate level of difficulty

appropriately challenges students' skills and as they achieve goals, the mastery may signal an increase of perceived competence, self-regulation, and intrinsic motivation (Deci, 1975; Dweck, 2006; Ryan et al., 1992). Conversely, environments that do not reward or model mastery of appropriate challenges may result in students' decreased perceptions of competence as well as an increased perception of external controls (Harter, 1981b). Therefore, teachers should strive to create environments filled with opportunities for growth and mastery that build students' preferences for challenging materials. One method for doing so could involve offering a list of several activities and as students complete more learning activities, they earn higher grades (Schunk et al., 2014). Not only does this example encourage students to choose more challenge, it also gives them more options. This increased choice relates to feelings of autonomy and has shown positive correlations to an increase in perceived competence (Patall, Cooper, & Robinson, 2008).

Offering students choices also positively correlates with intrinsic motivation, effort, and performance (Patall et al., 2008). In one example, Patall, Cooper and Wynn (2010) gave one group of high school students one specific homework assignment while giving the other group a choice of assignments. The group that was given a choice of assignments demonstrated a higher homework completion rate and performed better on a test with similar information. This group also showed higher levels of intrinsic motivation and perceived competence. These results suggest that offering students choices in the ways they learn and demonstrate mastery could positively impact their perceived competence, intrinsic motivation, and ultimately their performance.

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As students work to master new topics, judgement-free feedback that conveys effective completion of a task, mastery, or growth builds feelings of competence and intrinsic motivation (Deci, 1975; Dweck, 2006). On the contrary, feedback that conveys failure on a task or judges an individual's worth diminishes feelings of competence and hinders intrinsic motivation (Deci, 1975; Dweck, 1985, 2006; Harter, 1981b). Therefore, educators should refrain from feedback that judges students' intelligence or talent and instead offer praise for effort, taking on challenges, and growing from mistakes (Dweck, 2006). In the classroom, academic grades serve as the most typical form of feedback. Grades are inherently extrinsic and therefore often serve as an external reward or control rather than effective feedback (Ryan et al., 1985). When working for rewards, subjects typically chose the task with lower challenge or the path of least resistance to the reward (Shapira, 1976). This same pattern of behavior may occur with grades. Rather than completing challenging school work to learn new materials, students may choose the easiest work that will result in the highest grade.

A student working to achieve high grades could also represent an inherent desire for competence feedback (Lepper et al., 2005). When coupled with specific feedback, external controls such as grades may operate as a more effective method to build competence and intrinsic motivation (Deci, 1975). Therefore, grades and performance evaluations should always be paired with specific feedback to improve performance (Niemiec & Ryan, 2009). Teachers can also use constructive feedback to help students see mistakes as learning opportunities rather than as failures (Schunk et al., 2014; Dweck, 2006). Furthermore, teachers should give feedback that emphasizes students' efficacy

and growth rather than evaluation (Niemiec & Ryan, 2009). This type of feedback helps students develop a more malleable picture of intelligence as something that can be developed through experience, effort, and learning (Dweck, 2006).

A self-selected research topic offers one example of an effective application of optimal challenge and feedback. In this situation, the teacher helps to guide the students in topic selection and then works with them throughout the research and writing process. The teacher offers continual constructive feedback in order to guide students in their development and ensure they stay on track. At the end, the teacher holds a feedback-based conversation with the student and then gives a grade based on effort, amount learned, and the quality of the completed assignment. This process may help to develop student's curiosity and perceived competence and discourage project completion simply to please the teacher and receive high grades (Schunk et al., 2014).

Fostering Relatedness in School

In order to fulfill the need of relatedness, an individual must feel connected to others and have a sense of belongingness with individuals and with the community (Ryan & Deci, 2002). Relatedness is a key component in the maintenance of intrinsic motivation. A sense of relatedness creates a space for individuals to build competence and in the absence of relatedness and competence, motivation declines (Trenshaw, Revelo, Earl, & Herman, 2016). One study demonstrated that young children displayed a very low level of intrinsic motivation when they worked on an interesting activity in the presence of an adult experimenter who ignored their attempts to interact (Anderson,

Manoogian, & Reznick, 1976). Another study showed that students' peer group context predicted changes in their intrinsic enjoyment of school (Ryan, 2001).

Deci and Ryan (2000) argue that in some cases relatedness is less central to the development of intrinsic motivation than competence and autonomy. Many intrinsically motivated activities, such as a solo run or reflection in a favorite spot in nature, occur in isolation. In these cases, a sense of relatedness may not play as central of a role as competence and autonomy. However, learning in school does not occur in isolation. At minimum, students must interact with their classroom peers and teacher on a daily basis. As children progress to adolescence they may move between six to eight classes in a day, each time interacting with a new group of peers and teachers. Therefore, because of this large amount of time spent interacting and learning within the school community, relatedness plays a key part in development of academic self-regulation.

In the classroom, relatedness is often connected to how much the student perceives that the teacher likes and values him or her. Students' perception of the teacher and the teacher's behavior greatly affects student motivation (Katz, 2016). Those who perceive their teachers as warm and friendly demonstrate higher levels of intrinsic motivation (Ryan & Grolnick, 1986). Teachers can help build a sense of relatedness in their classroom by cultivating feelings that they, as well as other students, like, value, and respect all of the students (Niemiec & Ryan, 2009). Acknowledging the students' feelings and perspective may help to facilitate integration (Deci et al., 1994). Small practices can make a large difference in developing relationships between teachers and students. A 2018 study (Cook et al.) showed that a feasible relationship-building activity,

consistently greeting students at the door, could both decrease disruptive behavior and increase academic engagement. The increased engagement corresponded to an additional 12 minutes of engagement per hour of instruction or an extra hour of on-task behavior per 5 hours of instruction. Not only does this simple routine help students transition smoothly between classes, it also creates a daily opportunity for positive interaction, reminders, and increasing motivation.

Classroom culture and relationships with other students can also influence an individual's feelings of relatedness. Therefore, teachers can further develop a sense of relatedness in the classroom by creating cooperative classroom culture and fostering the development of new relationships. Interacting through team projects can be a key factor in helping students develop a sense of relatedness within the classroom. Teachers must remain aware; however, that while team projects can promote relatedness, they may also occur in isolation where each individual completes his or her part, adds it to the larger project, and rarely interacts with group members (Trenshaw et al., 2016). Therefore, the teacher plays an essential role in facilitating the development of cooperative group skills.

Research also suggests that students' gender may affect classroom relationships, perceptions, and experiences which in result may influence their motivation and emotion towards school. Girls typically perceive their teacher as more supportive, which positively influences student motivation. Conversely, boys frequently perceive their teachers as less responsive to and supportive of their needs and also adopted lower autonomous and higher controlled motivations (Katz, 2016; Lietaert, Roorda, Laevers, Verschueren, & De Fraine, 2015). Contrary to these reports, boys often receive more

time to talk, more praise, and more feedback and remediation. Additionally, students who report needing more support often report receiving less (Katz, 2016). This perception of support may partially explain other gender related differences in motivation. While girls have reported feeling less competent than their male counterparts, they also report greater feelings of autonomy (Deci & Ryan, 2000) and higher levels of self-determination (Williams & Deci, 1996).

Although theory and research supports the satisfaction of basic needs in classrooms as an integral part of developing students' self-regulation and sustaining intrinsic motivation, program practices often do not support need satisfaction. Therefore, the next sections will connect existing educational practices to satisfaction of basic needs and the development of academic self-regulation.

Environmental Education in Formal Education

In order to create systems that produce consistently high levels of learning among students with diverse needs, radical changes must occur (Council of Chief State School Officers, 2013). For many years, educators have sought to make these changes through various forms of environmental education. There is a natural overlap between the intended outcomes of environmental education and academic standards that may help shift what and how students learn in school (Ardoin, Bowers, Roth, & Hothuis, 2018). According to the North American Association of Environmental Education (NAAEE), EE is:

> A process that helps individuals, communities, and organizations learn more about the environment, and develop skills and understanding about how to

> address global challenges…EE is a key tool in expanding the constituency for the environmental movement and creating healthier and more civically-engaged communities (About EE and Why It Matters, 2017, para. 1).

Amongst environmentally focused objectives, environmental education also requires that student develop noncognitive skills in systems thinking, synthesizing and understanding data, listening and communicating, negotiating, visioning and evaluating options, and collaborative decision making and action (Monroe, 2012).

In order to guide educators in the development of high quality instructional EE materials, the North American Association for Environmental Education (NAAEE) produced a document titled *Environmental Education Materials: Guidelines for Excellence* (2004). Within the document, the NAAEE lays out six key characteristics of environmental education. These include: fairness and accuracy, depth, emphasis on skills building, action orientation, instructional soundness, and usability. Each of these areas highlights the importance of using interdisciplinary materials based on substantiated claims. The goals focus on critical thinking, applying skills to issues and building action skills that help learners develop real life critical skills that allow them to look at all sides of an issue. By helping students develop these skills through environmentally focused lessons, teachers can guide students to learn both real world skills and environmental content.

Most research on environmental education programs focuses on student improvements in environmentally related outcomes such as environmentally responsible behavior, environmental literacy, and environmental attitudes (Ardoin et al., 2018).

However, when thinking about the value of environmental education within the scope of the many competing needs of students and teachers, the research related to other constructs may be of even greater interest for practitioners. Here too, research has shown promising results from environmental education programs, both in the development of students' noncognitive affective skills as well as in academic achievement (American Institute for Research, 2005; Ardoin et al., 2018; Lopez, Campbell, & Jennings, 2008; Murphy, 2003). Some specific examples of these outcomes include concepts such as research skills (Cincera & Maskova, 2011), chemistry skills (Bartusevica, Cedere, & Andersone, 2004) and mathematics and science-process skills (Haney, Wang, Keil, & Zoffel, 2007).

When analyzing the results of environmental education programs, it is crucial to understand that within the discipline, programs vary greatly in duration, rigor, depth of analysis, and scope of topics (Ardoin et al., 2018). Therefore, it is vitally important to keep the findings in context and limit expectations about the crossover of results from one program to the next (Office of Superintendent of Public Instruction, 2007). This limitation further underscores the importance of understanding the nuances of specific programs in order to offer specific and research-based practices for improved program implementation. With these limitations in mind, the following program descriptions aim to offer further insight into examples of quality environmental education programs as well as some of the associated student impacts.

A 2005 study by the American Institutes for Research analyzed the impacts of outdoor environmental education for 255 at-risk 6th graders in California. The students

from four elementary schools attended week-long residential outdoor learning programs and participated in a variety of outdoor science learning activities that were aligned to academic science standards. Students participating in this program showed significant improvement in classroom behavior, cooperation, and conflict resolution skills as well as increased classroom engagement, motivation, and environmentally responsible behavior. These students also demonstrated a 27% increase in mastery of tested science concepts. Additionally, in comparison to non-English Language Learner (ELL) students, ELL students demonstrated significantly greater gains in cooperation, leadership, relationships with peers, and motivation to learn. One student said, "I think that I have changed after going to Outdoor school. I felt less bored, learned a lot about science, and made more friends" (American Institute for Research, 2005, p. vi).

The Boston Schoolyard Initiative (BSI) was an example of an ongoing policy change used to create systems to support the redesign of urban play spaces outside of Boston schools. Through the program, barren schoolyards were transformed into outdoor classrooms and play spaces. The changes were used to encourage more outdoor play and learning as well as a space to bring the community together. The implementation of green spaces, and integration of physical activity into learning, helped to improve students' well-being as well as their standardized test scores (Lopez et al., 2008).

In 1995, Alice Water started the Edible Schoolyard Project in Berkley, CA. At a rundown middle school, she created an organic garden that became the central teaching environment. Students learned about all of the components that effect the food they grow and eat and then applied that knowledge through a classroom kitchen. Today, the

organization trains teachers from across the country in "edible education" curriculum and pedagogy. A 2003 study of the project showed that in comparison to students' who were not involved in the program, students who participated in the Edible Schoolyard showed greater academic progress as well as gains in ecological knowledge. The students who gained the most in ecological knowledge also reported eating more fruits and vegetables (Murphy, 2003).

Although many EE programs have demonstrated extraordinary results, schools still face numerous barriers in successfully implementing environmental education. Some of these barriers include:

1. Logistical: lack of time, funding, or transportation;
2. Educational: both formal pre-service training as well as ongoing professional development;
3. Attitudinal: students, teachers, administrators, and public perception of the importance and interest of environmental education;
4. Conceptual: the place of environmental education in the schools setting, especially within the growing importance of standardized testing (Anderson & Jacobson, 2018; Ernst, 2012; Ham & Sewing, 1988; Monroe, Scollo, & Bowers, 2002;).

In a national survey of teachers conducted in 2000, only 27% of teachers indicated that specific environmental standards are included on state or district standardized tests (University of Maryland Survey Research Center, p. 29). As highlighted at the beginning of Chapter 2, schools put an increasing emphasis on passing

tests and teaching curriculum aligned to the tests. Therefore, teachers often feel as though they do not have the time nor freedom to teach other topics (Ernst, 2007, 2009; Melnick & Meister, 2008). Two of the top reasons for not teaching environmental education are consistently stated as, "Not relevant to my curriculum" and "Too much other material to cover" (University of Maryland Survey Research Center, 2000, p. 31). Although many states have changed guidelines since these data were collected, environmental standards are still not a primary focus of academic standards nor standardized tests (Minnesota Department of Education, 2009). Therefore, as previously articulated, environmental education must offer other benefits to teachers if they are going to take the extra time and effort needed to include it in their already overfilled schedule.

Research also points to the idea that teachers may not fully understand all of the benefits of environmental education. In a 1988 study, where teachers ranked various nontraditional subject areas, they ranked the following topics as more important than environmental education: self-concept enhancement, safety education, creativity enhancement, values clarification, music and art education (Ham & Sewing). In a different study, 22.4% of the teachers identified "to demonstrate that what students are learning in class is relevant to everyday life" as a reason for teaching environmental education and only 4% identified "it's a good way to teach problem solving or decision making skills" (University of Maryland Survey Research Center, 2002, p. 30). These results highlight how the teachers did not fully identify motivations that align with the researched benefits of environmental education. This lack of understanding emphasizes the gap in practitioners' understanding of and ability to implement educational research,

therefore underscoring the importance of offering practical solutions and guidelines for educators working in the field. Environment-based education is one solution to overcoming many of these barriers and misunderstandings.

Environment-Based Education

Environment-based education is an instructional framework that is applied to create entire standards-based education programs that use the environment and related issues as a context for instruction (Lieberman & Hoody, 1998). This pedagogical approach builds on the previously outlined components of quality environmental education lessons and may help to combat many of the criticisms and barriers that prevent effective classroom implementation, while also producing promising results in both academic achievement and the development of affective skills. Furthermore, its research-based strategies offer an instructional method that is student-centered and may aid in satisfaction of the basic psychological needs and development of academic self-regulation. As analyses of high-performing schools have shown, no single characteristic leads to immediate change or school success. Rather, years of sustained commitment to the implementation of research-supported pedagogy result in long-term changes in school practices and outcomes (Office of Superintendent of Public Instruction, 2007). Therefore, the multi-faceted approach to school reform through environment-based education offers a highly effective approach to implementing the large-scale changes necessary to satisfy students' basic psychological needs and develop academic self-regulation.

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Unlike traditional environmental education programs, environment-based education focuses on aligning material to academic content standards so that students will achieve proficiency (Lieberman, 2013). That is not to say other forms of environmental education are not aligned to state standards, but rather that the main focus emphasizes teaching students about the environment, not academic standards. This shift in focus from traditional environmental education highlights a strength of environment-based education. By using the environment as "an authentic and dynamic context" (Lieberman, 2013, p.42), teachers can help students develop interdisciplinary critical-thinking skills, while also helping them achieve proficiency in the required standards.

As Richard Louv (2005) notes in *Last Child in the Woods*, environment-based education is over a century old. Early advocates of this form of experiential education criticized the formal school system for its lack of relevance to students' daily lives. In 1899, John Dewey wrote, "From the standpoint of the child, the great waste in the school comes from his inability to utilize the experiences he gets outside the school in any complete and free way within the school itself; while on the other hand, he is unable to apply in daily life what he is learning at school" (p.89). Years later, in his most famous work *Education and Experience* (1938), Dewey summarized the tenants of progressive, experiential education and further encouraged educators to immerse students in the local environment and to allow students to use their senses to discover the natural world.

Although the idea of using the local environmental as a grounding context is not new nor radical, it has only recently taken hold as a formal instructional technique. In 1998, through the State Environmental Education Roundtable, Gerald Lieberman and

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Linda Hoody published a report documenting the success of 40 schools using comprehensive environment-based programs. This report, titled *Closing the Achievement Gap: Using the Environment as an Integrating Context for Education*, has served as a foundational document for researching and guiding development of environment-based education programs.

After the publication of this report, environment-based education, also referred to as EIC (using the Environment as an Integrating Context for learning; Lieberman & Hoody, 1998), was frequently touted as a progressive solution to improve both academic achievement and student behaviors. Subsequent research studies of environment-based education programs showed patterns of increased academic achievement across disciplines (NEETF, 2000; NEETF, 2002; SEER, 2000). A 2004 study of 12 Florida high schools implementing environment-based education programs showed statistically significant improvements in achievement motivation and critical thinking skills in 9^{th} and 12^{th} grade students (Athman & Monroe, 2004; Ernst & Monroe, 2004). Another study showed improved attendance, behavior, and attitudes of students in 10 South Carolina middle schools (Falco, 2004). Based on this promising research, organizations conducted case studies, developed guidelines, and offered professional development programs to help schools implement environment-based education. Many individuals involved with the implementation felt great optimism about the potential change environment-based education could bring to the U.S. school system. One case study went so far as to claim, "These ten programs are harbingers of change, of a new era for our schools and for our schools and for our children" (NEETF, 2002, p. 4). Although the programs did bring

change to their local communities and school systems, the change was not as widespread as some may have hoped.

Despite the existing research supporting environment-based education practices, relatively few teachers have adopted the practices (University of Maryland Research Center, 2000). Like many movements in education, this one also lost some momentum and a majority of the research surrounding the benefits seems to have diminished in the mid 2000's. More current research and education plans often refer to buzz words such as "integrated environmental and sustainability education" (Wheeler & Ruskey, 2011). However, the premise of environment-base education still holds true: integrating the local environment with standards-based practices engages students and helps them to develop vital critical thinking skills (Lieberman, 2013). These successes are evident in the many schools and individual classrooms that still work to implement environment-based education, as shown through Lieberman's more recent publication *Education and the Environment: Creating Standards-based Programs in Schools and Districts* (2013). Despite the fact that much of the existing data have been ignored by the education establishment (Louv, 2005), many dedicated educators work to apply the principles of environment-based education in their own schools and communities. The following two examples offer an overview of exemplary environment-based education programs.

Oil City Elementary Magnet School, a small rural school in Louisiana, turned to environment-based education when faced with closure due to low enrollment and budget cuts. Because of the school's proximity to a large lake, and the importance of industries such as oil and gas, agriculture, and forestry, administrators determined that investigating

local environmental issues would make learning more authentic. After receiving training in nationally recognized programs such as Project Learning Tree (PLT), the school overhauled their curriculum and instructional practices. A typical learning experience integrates hands-on activities with stories, writing, science, and discovery, all of which are found in a favorite activity, "The Forest of S.T. (short-tailed) Shrew" (Project Learning Tree, 2006). The students begin by acting out a story and then creating a PowerPoint to illustrate the animals in the story. Next, they go outside to visit a "decomposition station" created from an overturned oak tree. Here, they search for some of the creatures found in the story. While exploring, the teachers help students make connections to the ecological role of each animal. The students then synthesize their learning from both the story and the hands-on experience with a habitat drawing including flip up windows to reveal at least five animals. This final activity integrates language arts, science, and art skills and also creates a unique opportunity for assessment of understanding (Haines & Kilpatrick, 2007). This example highlights how successful implementation of environment-based education engages students with their local community while still teaching key academic skills. Although the program does not focus on testing, standardized scores often rise. In the case of Oil City Elementary, over the years following the implementation of the environment-based education program, the school improved 48.6 points on the Iowa Test of Basic Skills (a nationally administered standardized achievement test) and surpassed the state average (Haines & Kilpatrick, 2007).

INFLUENCE OF ENVIRONMENT-BASED EDUCATION

The Prairie Science Class (PSC) grew out of a partnership between Fergus Falls Independent School District 544 in Minnesota and the U.S. Fish and Wildlife Service's National Wildlife Refuge System (NWRS). Before the partnership, The Prairie Wetlands Learning Center had relied on traditional environmental education programming centered on one-time experiences for school groups. The center transitioned to using the local prairie wetland ecosystem as an integrating context for real world learning. Students from Fergus Falls Middle School were split into two groups to spend half the school day learning science, math, and writing through field-based learning at the Center. In one example unit, students learned to tag monarch butterflies. They then wrote to students in Mexico who lived near the butterflies' winter homes. In another unit, students learned to band mallards, applied math skills to measure and weigh the birds, and then compiled scientific reports about the process. A program evaluation identified that students who attended PSC scored significantly higher on the reading and writing Minnesota Comprehensive Assessment in comparison to peers in other ISD 544 classrooms. These students also scored above the state average in reading and math and showed an increased ability to problem solve and collaborate (Ernst & Stanek, 2006).

Of course, amidst these successes, environment-based education schools are not immune to the barriers faced by schools, teachers, and students across the country and even the most successful program must overcome numerous barriers. For example, as a part of a small rural community, Oil City Elementary still encountered financial problems and in 2016 it was merged with another school in a nearby community (March, 2016). This closure highlights a need for further research that continues to document the

potential effects of environment-based education on students' school experiences. Without additional research, and continued examples of how to apply that research, programs such as these will continue to be underfunded. Existing research also supports this point and has identified additional barriers and opportunities for implementing environment-based education (Ernst, 2007; Ernst, 2009). A 2007 study found that addressing the following areas may help more teachers implement environment-based education: (a) environmental sensitivity, (b) environmental literacy knowledge and skills, (c) receptiveness to environment-based education, (d) training in environmental content, (e) environment-based education training, (f) awareness of positive student outcomes, and (g) supportive school climate (Ernst).

With awareness of both the benefits and barriers in mind, the next six sections will discuss how environment-based education brings together six research-based pedagogies: interdisciplinary instruction, community-based investigations, collaborative instruction, constructivism, independent and cooperative learning, and teaching grounded in the context of local natural and community surroundings (Lieberman, 2013). Each pedagogy will be analyzed in further detail to highlight the research-based practices, results, and potential implications for satisfaction of psychological needs and development of self-regulation. It is important to note that environment-based education has not previously been studied through the lens of self-determination theory. Therefore, the connections made in the following sections are made from extrapolations of previous research and have not necessarily been studied in the exact context that is referenced.

Interdisciplinary instruction.

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The current emphasis placed on state academic standards and corresponding testing has often resulted in schools abandoning extra-curricular programs and focusing on a textbook-based curriculum (Franklin, 2004). Teachers frequently explain the lack of environmental education in their classrooms by citing its lack of relevance to the required curriculum or the need to teach too much other content (Ham & Sewing, 1988). This thinking highlights a conceptual barrier in that teachers do not see the relevance of using environmental education as an integrating context, but rather view it as an additional subject to teach. Therefore, one recommendation for increasing implementation of environmental education is to offer examples of methods to integrate the discipline into areas of study other than science (Ham & Sewing, 1988). Environment-based education capitalizes on this recommendation and the resulting pedagogy and practice are rooted in cross-disciplinary planning, instruction, and learning.

In his book *The School and Society* Dewey writes, "Experience [outside the school] has its geographical aspect, its artistic and its literary, its scientific and its historical sides. All studies arise from aspect of the one earth and the one life lived upon it" (1899, p.106). Dewey goes on to argue that although real-world problems are multi-faceted, school learning often occurs in a one-dimensional manner. Students learn skills in isolation and are unable to see the connection from their home life to their school life and vice versa.

Environment-based education teachers challenge this isolated view of education by breaking traditional subject boundaries to offer instruction that combines course content. Consider the following scenarios:

1. Student A attends math class and learns how to calculate the slope of a line. Next, this student moves on to science class where she listens to a lecture about climate change. Later, in language arts, the student reads the classic book *Heart of Darkness* in preparation for an Advanced Placement (AP) Language test. Finally, in U.S. History, she learns about the era of deregulation.
2. Student B spends the morning working on an interdisciplinary project. First, he begins by reading an excerpt from *Silent Spring*, another book referenced on the AP Language test (College Board, 2004). Next, he conducts his own research to identify how legislation has changed since the publication of *Silent Spring*. He collaborates with fellow students to discuss findings. The students are then presented with a challenge: design a prototype of a more ecofriendly car that still performs as well as a standard car. They will be evaluated on the speed of the car (calculated using slope) and the environmental considerations.

Rather than learning the skills in isolation, Student B investigated an environmental topic which required application of a variety of knowledge and skills acquired across disciplines. This integration helps overcome barriers such as time management and meeting all of the required academic standards. Both beginning and experienced teachers feel underprepared to teach reading and language arts standards and curriculum (Melnick & Meister, 2008). By overlapping materials and topics, teachers can use one lesson to help students learn skills that are applicable to multiple subjects.

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Integrating various disciplines through issue-based learning can also help students increase awareness of issues and ideas for taking action while developing critical thinking skills (Gray, Elser, Klein, & Rule, 2016). Furthermore, this integration and application of skills may explain some of the patterns of increased test scores seen across effective environment-based education programs (Bartosh, Tudor, Ferguson, & Taylor, 2006). Learning in such an interdisciplinary manner helps prepare students for the challenges they will face outside of school. The most recent United Nations Sustainable Development Goals Report (2018) highlights progress and gaps in the achievement of the 17 Sustainable Development Goals outlined in the 2030 Agenda for Sustainable Development. The agenda creates a blueprint for the United Nations Member States for peaceful and prosperous development for current and future generations. Within these goals, the UN identifies the importance of promoting lifelong learning, increasing access to sustainable energy, and achieving food security. The solutions for these lofty goals lie in complex and interdisciplinary thinking and collaborating. In order to contribute productive solutions, today's students must be prepared with the skills to tackle these multi-faceted issues. Therefore, teaching and learning through interdisciplinary topics helps students develop skills necessary to succeed in an increasingly interconnected society.

Research surrounding students' academic motivation often suggests offering rationale for why a learning activity is useful (Niemiec & Ryan, 2009). However, by learning in a way that mimics problem-solving outside of school, students may develop their own understanding of the utility of the learning activities. Rather than a teacher

always answering, “Why do we need to learn this?” the students make the connections for themselves. By developing these personal connections and a justification for the learning activities, the student is more likely to feel a sense of satisfaction for autonomy needs (Deci et al., 1994; Garn et al., 2019; Ryan et al., 1992, Ryan & Deci, 2000).

Independent and cooperative learning.

Through opportunities for both independent and cooperative learning, students in environment-based education programs develop inter- and intra-personal skills needed to succeed in college and/or careers (Lieberman, 2013). Successful programs should help students develop important group membership skills and offer support to students as they form their own teams (Lieberman et al., 2002). Collaborative group work has shown a positive effect on fostering self-regulated learning in secondary students (Dignath & Buttner, 2008). Building a classroom culture of collaboration, practice, and repetition helps develop students’ enthusiasm for learning and creates a space for the critical thinking necessary for deep learning (Kolodoner et al., 2003). Additionally, building a classroom culture that values collaboration and cooperation helps to emphasize the importance of learning and to deemphasize social comparison and competition (Schunk et al., 2014).

In order to succeed outside of school, students also need to develop the skills to work independently. Because students are often working independently on their own portion of a project, environment-based education may help to foster the development of independent work skills. As projects unfold, and teachers often learn alongside students, they also model positive learning habits, help students set goals, and offer constructive

feedback, which will support the development of perceived competence (Brandenberger, Hagenauer, & Hascher, 2018; Deci & Ryan, 2002).

Collaborative instruction.

It takes more time to create educational, standards-based projects than it does to open a textbook and pass out the corresponding worksheet. Therefore, successful programs need a support team that delegates and collaborates to create meaningful projects and learning opportunities for students. Teachers need space within their day to connect with one another, share ideas, and build interdisciplinary projects. A whole school model, based on the theories of "diffusion of innovations" (Rogers, 2003) and "tipping point" (Gladwell, 2002), advocates for connecting teachers, administrators, and other community members to help implement and support new ideas (Duffin et al., 2003; Lieberman, 2013; Powers, 2004). This collaboration should involve all stakeholders throughout program stages including planning, implementing, and communicating results (Lieberman, 2013; Monroe & Athman, 2001). Another key factor in these theories states that word of mouth, reputation, and context are critical pieces that will affect the adoption of new practices. By engaging and supporting key stakeholders, and then communicating results, new programs and ideas can gain momentum (Duffin et al., 2003).

A large gap exists between findings in research and teachers' intentional implementation of strategies (Farrington et al., 2012). While many factors contribute to this gap between research and practice, teachers' perceived competence for teaching environmental education is of particular importance to this discussion. Because teachers frequently cite a lack of perceived competence for environmental education as a barrier to

implementing environmental education topics in their classroom, it is likely that without support they will not implement changes, no matter how much research supports the ideas (Monroe et al., 2002). Building a connected community and offering a space to collaborate helps to support teachers who may feel less comfortable teaching science or environment-based concepts.

Teacher collaboration also further supports students' interdisciplinary learning. In addition to offering space for students to make connections between subjects, when students see teachers working together they see a real-world example of how all subjects are interconnected (Falco, 2004). As previously explained, interdisciplinary learning may help students to understand the rationale for learning activities and in effect help them to feel more autonomy for their learning (Ryan & Niemiec, 2009). Additionally, giving teachers space to collaborate and initiate new projects based on their students' interests, rather than requiring them to follow a strict curriculum, supports development of teachers' autonomy. Research has shown that autonomy supportive schools leads to autonomy supportive teachers, which in effect leads to the development of autonomy in students (Deci et al., 1982).

Community-based investigations.

Many researchers and practitioners argue that education should focus on developing students' citizenship readiness in order to become contributing members of society through the development of lifelong learning skills and the ability to make responsible decisions about the surrounding world (Council of Chief State School Officers, 2013; Hoody, 1996). In an increasingly complex and connected world, students

need an array of skills such as systems thinking and action competence to solve the variety of problems they may face. The National Association of Environmental Education (NAAEE) web page "What is EE and Why It Matters" explains that environmental education can help individuals "develop skills and understanding about how to address global challenges…(and) make intelligent informed decisions" (para. 2). Furthermore, the NAAEE highlights the power of environmental education to transform, inspire, and motivate. Environment-based education capitalizes on this power by rooting learning in community-based investigations which provide students with the opportunity to actively engage in real-world problems and issues. This type of active engagement supports knowledge acquisition as well as improved motivation because students are more motivated when they can see the usefulness of a task and its corresponding impact (Kolodoner, 2003; Pintrich & Schunk, 1996).

Environment-based education also incorporates components of service learning, which has shown positive impacts on students' academic achievement, perceived competence, and career motivation (Hiller, 2012). Service-learning experiences that require both hands and mind, challenge students to investigate local issues, solve real problems, and produce meaningful products. Like most complex societal issues, these service learning problems and experiences cannot be solved in a short time frame. By connecting students to real problems, and giving them ample time and space to engage in these problems, they gain experience more equivalent to that of the world outside their classroom. In doing so, students develop necessary skills for real world success while also strengthening their connection to the local community. They also have a greater

likelihood of creating meaningful change in their own community. By investing themselves in solving a problem, and having choice in how that problem is solved, students are more likely to develop personal relevance and to feel autonomous (Dignath & Buttner, 2008). Additionally, as students work collectively towards a greater good, they may have opportunities to develop closer relationships with both teachers and peers. This strengthening of relationships may help satisfy students' needs for relatedness (Ryan & Niemiec, 2009).

In order to gain deeper meaning and understanding of these experiences, students should reflect upon and communicate their learning activities to their community (Lieberman et al., 2002). This component of contemplation and communication is rooted in both constructivism and experiential education, where reflection plays a large role in allowing the learner to review the experience and make their own personal meaning (Schunk et al., 2014). Especially when paired with support tools and constructive feedback from teachers, reflection may help students learn from their experiences and develop greater feelings of competence (Dignath & Buttner, 2008; Niemiec & Ryan, 2009).

Constructivist approach.

The constructivist approach views learning as a social process where learners construct meaning from both individual and group activities (Bruning, Shraw, Norby & Ronning, 2004). Schunk and colleagues (2014) compiled the following list of the 10 key principles of constructivist teaching:

1. Create agency for learning;

2. Providing time and space for reflection;
3. Centering the classroom on collaboration and cooperation;
4. Using authentic learning tasks and assessment of mastery;
5. Facilitate classroom discourse;
6. Provide numerous opportunities to practice thinking and learning;
7. Provide support tools for learning;
8. Ask student to create and use relevant artifacts;
9. Offer scaffolding to build upon and support student learning;
10. Build a classroom culture that values learning and respect.

Many of these principles overlap with other components of environment-based education and therefore do not merit further discussion. However, the components of scaffolding and creating support tools for learning are especially relevant in highlighting key areas where environment-based education may fulfill the basic psychological needs and help to develop academic self-regulation.

Individuals arrive at meaning by selecting relevant information and building upon what they already know. All new learning occurs because of a transfer of knowledge based on previous learning (The National Academies Press, 2000). Therefore, when educators create relevant and meaningful education programs, learners can build on previous knowledge (Athman & Monroe, 2001). Both teaching and learning should be viewed as learner-centered activities that build upon students' past experiences to help them understand new material. Because learning is also a developmental process, scaffolding is an essential support to help students comprehend new content (Kolodoner

et al., 2003). Teachers or other students can offer support through models, demonstrations, constructive feedback, or think-alouds to help students develop new skills and master tasks (Schunk et al., 2014). In this way, scaffolding also supports the development of perceived competence as students begin to accomplish tasks that they otherwise may not have been able to master (Niemiec & Ryan, 2009).

Through this constructivist approach, environment-based education puts the responsibility on the student to learn, analyze and solve problems. The teacher offers multiple perspectives and guidance as students work through real life and messy social issues. They can engage in debates and take political action in their community, but the work is driven by the students, not the teachers. This shift in responsibility, from teacher to student, may also assist in creating a non-controlling environment, which is vital in the development of children's autonomy (Grolnick & Ryan, 1987).

Grounded in the context of local natural and community surroundings.

The local context weaves all of the pedagogies of environment-based education together, thus allowing students to connect their learning and make it personally relevant. Dewey offers the example of a superintendent telling him of students who did not understand the connection between the stream outside their school and the Mississippi river in their textbook. He goes on to write, "When we think that we all live on the earth, that we live in an atmosphere, that our lives are touched at every point by the influences of the soil, flora, and fauna…and then think of what the school study of geography has been, we have a typical idea of the gap existing between the everyday experiences of the child and the isolate materials supplied in such large measure in the school" (1899, p.90).

Here, Dewey highlights the gap that exists between a student's daily experiences in their local community and the large-scale issues and concepts that they typically learn about in school.

David Sobel expands upon this idea using the example of the water cycle. When learning about the water cycle, students often learn about it as an abstract diagram with many arrows. If asked to explain it in real concepts, they struggle to connect the diagram with the water that moves around them. Sobel suggests an alternative method of learning where students are engaged in a hands-on investigation of the movement of water in their local watersheds (1996). By grounding learning in the local environment, educators avoid creating the gap between far-off abstract concepts and the students' daily experiences. Instead of thinking about the world with a fragmented view, students begin to develop a systems-thinking approach that helps them solve increasingly complex problems (Sobel, 2004).

Because each school's surrounding ecosystem is unique; each school's program will look different (Lieberman & Hoody, 1998). In northern Minnesota, schools might use local issues such as mining in the Boundary Waters and invasive species like the Emerald Ash Borer. A school further south in the state may investigate issues surrounding prairie restoration or farming. Investigating local issues helps root learning in reality and results in authentic learning experiences, which in effect may help students develop a greater sense of control and autonomy and internalize the rationale for learning (Niemiec & Ryan, 2009; Rigby et al., 1992; Taylor et al., 2014).

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Environment-based education instructional methods may also help students develop self-regulation through immersive, outdoor learning experiences. Although not all environment-based education learning will occur outside, learning through the local and natural surroundings often presents opportunities that require students to be outside, immersed in the natural world. Executive functioning and self-regulation tasks, such as those required in a formal education setting, put high demands on mental resources. These resources are often overused and depleted in daily life, which has serious impacts on goal-pursuit and well-being (Kaplan & Berman, 2010). However, interactions with nature have shown to have a restorative effect on individuals' attention, well-being, and ultimately their cognitive performance (Berman, Jonides, & Kaplan, 2008; Kaplan, 1995; Kaplan & Berman, 2010).

Connecting Self-Determination Theory and Environment-Based Education

Cultures, and subgroups of cultures such as the work or school environment, offer an avenue of support and tools that may help individuals satisfy basic needs if the values of the group are well integrated into the individual's self. If these values are incongruent with the self, then this group and its values may act as a detriment to the individual's well-being (Deci & Ryan, 2000). When students feel as though their own values are not congruent with those of their school environment, the incongruency undermines the students' expression of self and their ability to self-regulate. Therefore, an important opportunity exists for educators and researchers to find methods in which to craft the school environment into one that is in line with student values and perceptions of self.

Furthermore, researchers have called for future studies that examine if intrinsic motivation and self-regulation can be developed, and not just sustained, in children, and if so, to what extent (Garon-Carrier et al., 2016; Gnambs & Hfanstingl, 2015). In order to answer this question, a better understanding of programs and teacher actions that impact basic psychological needs and self-regulation is needed. Some researchers, such as Niemiec and Ryan (2009), have applied self-determination theory to educational practices and offered broad suggestions as to ways teachers can develop autonomy, competence, and relatedness in the classroom. In a text titled *Improving Academic Achievement*, Deci and Ryan (2002) summarize the key components of self-determination theory and highlight fundamental research that identifies key practices for teachers wishing to foster students' self-determination. The authors summarize the advice through the following statement, "By offering optimal challenges, providing feedback that is not evaluative of the person, giving a meaningful rationale for requested behavior, acknowledging feelings, providing greater choice, and setting up cooperative learning opportunities, teachers can foster students' self-determination" (Deci & Ryan, 2002, p. 81). While these findings and suggestions are beneficial, a need for specific, action-oriented solutions for teachers, administrators, and policymakers exists.

On the other hand, the field of environmental education would benefit from better articulating the range of impacts quality environmental education has as an overarching teaching philosophy, rather than a content specific-discipline. A 2018 review of published environmental education research identified that 91% of the articles measured environmentally-related constructs (Ardoin et al.). In contrast, only 3% of the articles

focused on personal characteristics such as self-esteem and autonomy. Additionally, structured instruments were the primary method of data collection (81%), in comparison to interviews (29%) and observations (19%). While the majority of these studies found positive impacts of environmental education, the applications of these findings may be limited by the topic scope. Although teaching students to care for the environment is arguably an important outcome, it may not be the most compelling argument for teachers to add on to their already busy schedules (Ham & Sewing, 1988). If instead researchers can highlight a larger scope of benefits, such as the affective and academic impacts of quality environmental education, these findings may help overcome some of the perceptual barriers teachers face. To help teacher feel confident, comfortable, and supported, these outcomes should be coupled with practical methods for implementation (Ernst, 2007). Consequently, models of effective long-term solutions, such as environment-based education, must be tested and implemented (Ardoin et al., 2018). Environment-based education already applies pedagogy that would seem to foster satisfaction of the three psychological needs and help to sustain self-regulation. However, there is not any current research that examines self-determination theory in the context of environment-based education. Therefore, the current study analyzed the potential of environment-based education's suite of education practices to create a more holistic and systemic approach to education that offers greater potential for change than isolated teaching strategies.

Chapter 3

Methodology

Introduction

This study was rooted in a pragmatic paradigm where the focus of the research lay in application and solution to problems (Patton, 1990). Lawmakers, administrators, and teachers all use empirical evidence to influence and improve education through methods such as standards-based reform, influencing Supreme Court cases, and altering public policy (Cawelti, 2003; Exemplary Practices, 2007). However, effective teaching also requires an understanding and application of evidence-based practices that move beyond the statistical data to impact day-to-day classroom practices (Melnick & Meister, 2008; Farrington et al., 2012). Therefore, a "dominant-less dominant" design, where the emphasis lies on the quantitative study and qualitative results support these findings, was used to investigate the influence of environment-based education on secondary students' academic self-regulation, academic autonomy, perceived competence for learning, and relatedness within the school context.

The current study applied this design to emphasize the quantitative paradigm, while allowing for specific attributes of a qualitative design, which served both as data triangulation and extension of the inquiry (Creswell, 1994). A deductive review of the theory and literature drove this study and guided analysis of the qualitative data. The quantitative data measured the extent to which environment-based education impacts students' academic self-regulation and satisfaction or frustration of basic psychological needs.

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The qualitative data, in the form of school observations and student interviews, offered a more in-depth understanding of the quantitative results, including a potential view into why these results may have occurred. These findings were used to begin a preliminary discussion regarding the potential implications on classroom practices. The evaluation rubric (see Appendix D) was used to ensure each school met the defining characteristics of an environment-based education program. The rubric was also used alongside student interviews to offer insights into possible program characteristics that may have been influential in impacting self-regulation and need satisfaction. Together, these data were used to develop understandings that can guide teacher practices, program implementation, and further research.

These objectives were accomplished by studying existing environment-based education programs in five schools in northern Minnesota and Wisconsin. The focus was at the secondary level, grades 6^{th}-12^{th}. Academic autonomy, perceived competence, and relatedness in school are necessary for the development of students' academic self-regulation and intrinsic academic motivation. Academic intrinsic motivation and self-regulation are positively related to learning and achievement (Gnambs & Hanfstingl, 2015; Gotffried, 1985, 1990; Gottfried et al., 2001; Harter & Connell, 1984; Lepper, 2005).

Research Questions

1. Does environment-based education influence secondary students' need satisfaction and need frustration in academic autonomy, perceived competence for

learning, and relatedness in school, when controlling for age, prior participation and gender?

2. Does environment-based education influence academic self-regulation in secondary students, when controlling for age, prior participation, and gender?
3. What characteristics of environment-based education influence academic self-regulation, academic autonomy, perceived competence for learning, and relatedness in school?

Treatment

Existing environment-based education programs served as the treatment in this study. Environment-based education programs are formal education programs that utilize the following philosophies and practices (Lieberman, 2013; see Chapter 2 for full review of literature):

1. *Integrated interdisciplinary instruction:* All of the participating schools combined subject areas and skills to teach academic content standards.
2. *Combination of independent and cooperative learning*: Because independent and cooperative learning skills are equally essential for success in the 21st century, students had the opportunity to develop both.
3. *Collaborative instruction connects teachers, parents, students and community members:* Teachers worked in teams to share knowledge and integrate ideas. This teamwork spilled into the community to ensure all stakeholders were heard and engaged.

4. *Constructivist approach*: Learning was student centered and adapted to the unique needs and skills of individual students.
5. *Encourages active involvement in a civil society:* Students had the opportunity to engage in community-based investigations and service-learning projects. These opportunities provided students with meaningful context within which to ground their school learning. It also provided them with the skills necessary to actively engage in the world outside of school.
6. *Integration of local natural and community surroundings*: The unique context of the local community served as the connection between all of the other learning pedagogies. Students were engaged in solving real world problems that were relevant to their community.

In addition to a review of existing materials, the researcher used an existing evaluation rubric (Lieberman, Hoody, & Lieberman, 2002) to conduct at least one observation at each school (See Appendix D). This observation and evaluation served to validate each program and ensure that it met the defining characteristics of environment-based education.

Design

A one-group pretest-posttest design was used for this study (Creswell, 2014). Threats to validity as a result of this design included history, maturation, testing, and instrumentation (Campbell & Stanley, 1963). History, or events unrelated to the experimental variable that occur between the pre- and post- tests, posed the largest threat to validity in this study. However, the qualitative data served as a method of

triangulation to help to address this internal validity threat. Maturation threats occur when participant processes change as an effect of the passage of time rather than in response to the experimental variable. Although six months of time passed between pre- and post- tests, a growing body of research has shown a steady decline in self-determined motivation across a student's academic career (Gnambs & Hanfstingl, 2015; Gottfried et al., 2007; Gottfried et al., 2013). Therefore, results indicating a stabilization or reversal of this trend in declining self-determined motivation were not attributed to passage of time. Instrumentation refers to changes in calibration of an instrument or changes in observations. Because the questionnaire did not change, and was not subjective, it was assumed that measurement stayed consistent from pre- to post- tests. Furthermore, the six-month time interval between administration of the questionnaire helped to limit familiarity with the outcome measure (testing threat; Creswell, 2014).

Additionally, the pretest helped to address the internal validity threat of potential pre-existing differences relating to gender, age, and prior participation as these were accounted for as covariates in the statistical analyses. Although pre-existing differences due to academic achievement may have existed, treatment schools did not use standardized measures such as GPA to determine academic achievement. Therefore, this measure was not included in the statistical analysis.

The independent variable for the study was environment-based education, as described earlier in the Treatment section. The dependent variables for this study were academic self-regulation, academic autonomy, perceived competence for learning, and relatedness in school. Research shows that the satisfaction of these needs is central to

self-determination theory and leads to increased internalization, intrinsic motivation, and academic performance, as well as decreased academic anxiety (see Chapter 2 Literature Review). Therefore, the results of this study shed light on the role environment-based education may play in satisfying these needs, which offers valuable insight to various stakeholders in both traditional and environmental education.

Study Sites

In efforts to determine study sites, the researcher began by investigating schools in various environmental education-related and school reform networks including the Audubon Center of the North Woods Charter School Division, Innovative Quality Schools, and the Green Schools Network. The Audubon Center of the North Woods and Innovative Quality Schools both authorized innovative charter schools in Minnesota whereas the Green School Network included listings of environment-focused schools across the country. Criteria for the initial consideration for participation in the study included the following: a mission statement focused on learning through and about the environment; use of project-based learning; a community focus; and some type of outdoor learning. These criteria stemmed from the defining characteristics of environment-based education and allowed for an initial screening of schools to determine if they were potential sites for consideration. In addition, a criterion of being established for at least three years was used to ensure that the programs were established and stable, as opposed to just starting out and figuring out how to implement environment-based education. Also, the criterion of feasibility was used in this initial screening, as in order for it to be practical for the researcher to administer instruments, schools would need to

be located within approximately five hours of Duluth, making it viable to visit each school in one day. This process led to the identification of 12 schools in Minnesota and Wisconsin.

The school directors and/or lead teachers at these 12 schools were contacted by email (see Appendix A) and invited to contact the researcher to further discuss the details of the program and study. Of the contacted schools, five agreed to participate in the study, one declined participation, and six did not respond after multiple follow-up attempts were made. These five schools were further reviewed to ensure they met the defining characteristics (see the Treatment section in this Chapter). This review included obtaining further information about the school through their websites, blogs, and other publicly available information, as well as gathering information from an informal interview with school leaders, and reviewing this information using the environment-based education checklist described in the Treatment section. The five participating schools were located in a range of settings from urban to rural, which added to the external validity of the study. An in-depth evaluation of each school was also conducted in order to validate that each program met the defining characteristics of environment-based education (see Treatment and Appendix D).

Although it was not part of the inclusion criteria, all five schools were also classified as public charter schools. Students were not mandated to participate in these programs but rather elected to attend these environmentally focused, project-based schools. Many students referenced dissatisfaction at their previous schools, but formal data was not collected to quantify reasons for attending the current schools. Implications

of this classification are discussed in Chapter 5. See Appendix C for further information about the charter authorizer, school district and other pertinent information including setting and environmental focus.

Sample Description

Students in grades 6 through 12 at the previously described 5 schools were invited to participate in the study. Those for whom there was parent consent and for whom there was student assent were considered study participants (See Appendix B for assent/consent forms). The sample population consisted of 65 participants ranging in ages 11 to 18 in grades 6 through 12. Figure 3 reports the frequencies associated with each age group, rather than grade, as this information was used as a covariate in the analysis.

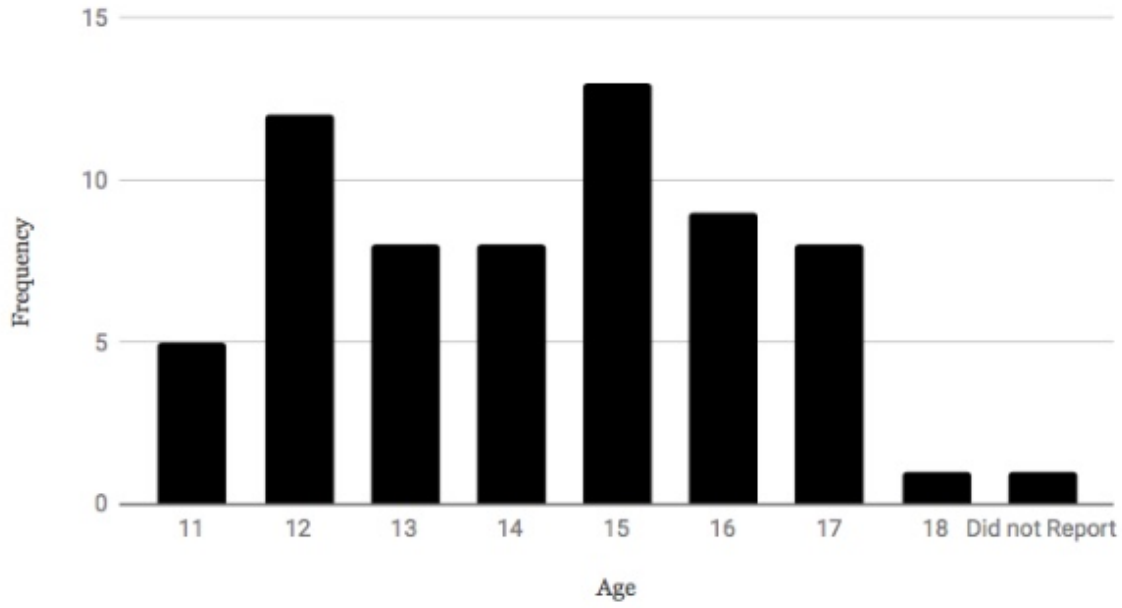

Figure 3. Distribution of Participants' Age

The majority of participants (88%) were white and 18% identified as American Indian. A small number of participants identified as other races or ethnicities, the

frequencies of which are reported in Table 1. Half of the participants were male (n = 33), approximately 46% were female (n = 29) and 3 chose not to report this information.

Table 1

Race and Ethnicity Demographic Information

	Frequency	**N (%)**
Total Sample	65	100
Race/Ethnicity[a]		
American Indian	12	18.2
Asian	1	1.5
Black/African American	5	7.6
White	58	87.9
Latino	1	1.5
Did not Report	1	1.5

Note. Race/Ethnicity[a]: percentages exceed 100% because participants could choose up to three race/ethnicity statuses

Approximately two-thirds of participants reported multiple years of participation at their school program. Table 2 shows the frequency and percentage breakdown of students' prior participation.

Table 2

Prior Participation

	Frequency	**N (%)**
Prior Participation		
Did not report	1	1.5
No	21	31.8
Yes	44	66.7
Years of Prior Participation		
1	15	22.7
2	12	18.2
3	10	15.2
4	4	6.1
5	2	3.0
6	1	1.5

Due to self-selection for participation in the study, students were not evenly distributed among the five schools. Additionally, attrition due to absences and change of schools impacted the final number of students who participated in the study. Table 3 summarizes student participation by school. See Appendix C for further information about each treatment school.

Table 3

Summary of Student Participation by School

	School #1	School #2	School #3	School #4	School #5
Total Number of Students	108	85	40	75	32
Students in study	18	18	9	1	19
% of School Population	16.7	21.2	22.5	1.3	59.4
% of Study Sample	27.7	27.7	13.8	1.5	29.2

Instrumentation

Students' scores on the Academic Self-Regulation Questionnaire (SRQ-A), and Need Satisfaction and Frustration Scale (NSFS) served as the observable measurement of students' academic self-regulation and satisfaction or frustration of basic psychological needs, respectively. Collectively, these scales provided insight into the extent to which environment-based education aided in the development of self-regulation and satisfied or frustrated the basic needs of autonomy, competence, and relatedness. These instruments

were combined into one questionnaire, for ease in administration, and were used for both pretests and posttests.

Academic Self-Regulation Questionnaire

The Academic Self-Regulation Questionnaire (SRQ-A; Ryan & Connell, 1989) is available through the Self-Determination Theory website. This questionnaire measures the extent to which academic regulatory styles were controlled versus autonomous. It was developed for use with students in late elementary and middle school. This questionnaire has been used extensively, and while a comparable SRQ was not designed specifically for high school students, Dr. Richard Ryan recommended the use of this scale for this study of secondary students due to its simplicity, ease of use, and validity evidence (personal communication, May 7, 2018).

Ryan and Connell (1989) reported expected correlations between this test and three other tests with dimensions of external and internal styles of motivation (*Intrinsic Versus Extrinsic Orientation in the Classroom Scale* (Harter, 1981), *Multidimensional Measure of Children's Perceptions of Control* (Connell, 1985), *Origin Climate Questionnaire* (deCharms, 1976). Ryan and Connell also tested for internal consistency using three samples of elementary school students from heterogeneous school districts (urban, suburban, and rural) in upstate New York. Internal consistency values ranged from .62 to .82, which indicated moderate to high levels of internal consistency.

The SRQ-A asks four questions about why children completed certain school related behaviors. Each question is followed by eight responses representative of the four regulatory styles analyzed through this scale: external regulation, introjected regulation,

identified regulation, and intrinsic motivation. Internalization of external regulations can be measured by using identified and integrated regulation as outcome variables (Deci et al., 1991). However, the SRQ-A does not include integration as this process typically happens later in life (Deci et al., 1991).

For each response, students circled "very true", "sort of true", "not very true" or "not at all true" to identify the level to which the response described them. The choices were scored as follows: "very true" was scored 4; "sore of true was scored 3; "not very true" was scored 2; and "not at all true" was scored 1. A higher score for each subscale indicated a higher level of that regulatory style.

The subscale scores were also combined to form the Relative Autonomy Index (RAI), ranging from -9 to 9. A positive score indicated that the individual was relatively autonomous in that domain whereas a negative score indicated a more controlled style of regulation. The controlled subscales (external and introjected) were weighted negatively and the autonomous subscales (identified and intrinsic) were weighted positively as follows: 2 x Intrinsic + Identified – Introjected – 2 x External. Both the individual subscale scores and the RAI were used for data analysis.

Need Satisfaction and Frustration Scale

The Need Satisfaction and Frustration Scale (NSFS; Longo et al., 2014) is an 18-item questionnaire that measures the extent to which each basic psychological need is satisfied or frustrated. It was developed to improve upon previous questionnaires, specifically in regard to measuring need frustration. It is common practice to measure need frustration by reverse-scoring need satisfaction items and then combining these

scores with need frustration items (Longo et al., 2014). However, recent research in this area suggests that low need satisfaction is not the same as high need frustration (Longo et al., 2014). Indeed, these appear to be somewhat independent constructs.

The NSFS asks people to indicate the degree to which they agree (using a Likert-type scale where 1 = strongly disagree and 7 = strongly agree) with the given statement about how they feel in a specific situation. Because this study focused on need satisfaction and frustration at school, the question stem stated, "In my school studies…" The NSFS contains six subscales with three items each per subscale; an average score for each subscale was calculated. Subscales include autonomy satisfaction (e.g., "I feel completely free to make my own decisions"); autonomy frustration (e.g., "I feel forced to follow directions regarding what to do"); relatedness satisfaction (e.g., "I feel very close and connected with other people"); relatedness frustration (e.g., "Sometimes, I feel a bit rejected by others"); competence satisfaction (e.g., "I feel highly effective at what I do"); competence frustration (e.g., "I sometimes feel unable to master hard challenges"). The scores on each of the subscales are averaged to determine a final score between one and seven.

Longo and colleagues (2014) found the NSFS to have a better factor structure and greater internal consistency than the Basic Need Satisfaction at Work Scale (Deci et al., 2001) and an adapted version of the Balanced Measure of Psychological Needs (Sheldon & Hilpert, 2012). Criterion validity was also established in that the need satisfaction subscales best predicted positive outcomes (job satisfaction, vigor, positive affect,

intrinsic motivation) whereas the need frustration subscales better predicted negative outcomes (exhaustion, negative affect, depression and anxiety; Longo et al., 2014).

Qualitative Interviews

Individual interviews lasting approximately 20 minutes were conducted with three to five students at each school. These interviews served as a method to better understand the ways in which environment-based education programs may have satisfied or limited frustration of basic psychological needs. The interviews followed a semi-structured approach and the following questions were used to guide conversation:

1. What do you do in this program?
2. What parts of this program do you like best?
3. Has this program changed the way you feel about your ability to initiate your own learning and make your own decisions in school?
    1. If the response is yes: What about this program has changed the way you feel about your ability to initiate your own learning and make your own decision in school?
    2. If the response is no: What limits your ability to initiate your own learning and make your own decisions in school?
4. Has this program changed the way you feel about your ability to do well in school or your ability to learn?
    1. If the response is yes: What about this program has changed the way you feel about your ability to do well in school or your ability to learn?

2. If the response is no: What do you think limits your feelings about your ability to do well in school or your ability to learn?

5. Has this program changed the way you feel about your connections or relationships with others at school?
    1. If the response is yes: What about this program has changed the way you feel about your connections or relationships with others at school?
    2. If the response is no: What do you think limits your feelings of connection with others at school?
6. Is there anything else you would like to tell me about this program?

Data Collection Procedures

Data collection occurred over the 2018-2019 school year. Prior to the beginning of the school year, school leaders/principals received additional information on the study, including the timeframe, data collection procedures, the consent process, and instrumentation, etc. This information was emailed and contained the actual parent consent and student assent forms (see Appendix B) that were distributed to students in the school's welcome packet or during the first week of school. In addition, the researcher scheduled the pretest administration date for each school. Although the initial aim was to schedule pretest administration as early in the school year as possible, some scheduling constraints resulted in pretest completion during the first week of October, within six weeks of the start of school.

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Once consent forms were collected and the research participants (students who assented to participate and obtained parental consent) were identified, each student received a unique study ID number. Pre- and post- tests were labeled with these study ID numbers. This study ID number and corresponding student name was recorded on a coding sheet maintained by the teacher and not accessible to the researcher. This code sheet ensured that students received the posttest that correctly corresponded to their pretest, allowing analysis of pre- and post- tests for each student. On the pretests, students were prompted to provide information as to their grade level, gender, race and ethnicity, and grades when they attended their current school. Thus, what the researcher had access to was information on ethnicity, gender, grade level by study ID number, as well as the pre- and post- data from the two research instruments.

Qualitative data was collected over the same school year (2018-2019). Each program was visited at least once for approximately three hours. During the visit, an environment-based education program evaluation rubric developed by Lieberman, Hoody, and Lieberman (2002) was used to guide observation and ensure that the participating programs met the defining characteristics (See Appendix D for the completed rubric). It also aided in identification of potential program characteristics that helped explain statistical findings and improve teacher practices. Observations offer the researcher an opportunity to identify unusual or distinctive features of a program, which may be beneficial for developing recommendations for future teacher development and programmatic changes (Creswell, 2014).

Teachers at each school were asked to select three to five "information-rich" students to participate in a semi-structured interview. These students did need to be the "best" students, in terms of metrics such as academic performance, motivation, or behavior, but needed to be willing to offer programmatic insights and engage in conversation. This was not considered a representative sample of all students, but rather was used a tool to gather additional insight about influential practices at each school. The interviews were conducted after students completed the posttest in a quiet space removed from distractions. During the interviews with students, data was recorded through field notes. After interviews at each program, and before interviews at the next program, data was transcribed and organized for analysis.

Data Analysis

One-way repeated measures analyses of covariance (ANCOVAs) were used to address the first and second research questions regarding if environment-based education influences secondary students' academic self-regulation as well as need satisfaction and need frustration. The analysis controlled for age, gender, and prior participation in environment-based education programs. Due to the primarily homogenous ethnic makeup of the sample (88% White), the analysis did not control for ethnicity.

Thematic coding of the qualitative data occurred through an inductive process of coding, identifying overlap, and interpreting the meanings (Creswell, 2014). This process began by first reading through all of the data, coding the data and aggregating it into themes, identifying overlaps and interrelations between the themes, and finally

interpreting the meanings into a general discussion (Creswell, 2014). Data analysis will be further described in Chapter 4.

Chapter 4

Results

Introduction

The purpose of this analysis was to determine if students in environment-based education programs demonstrated sustained or increased academic self-regulation and need satisfaction as well as sustained or decreased need frustration, after controlling for variances due to age, gender, and prior participation (Research Questions 1 and 2). All quantitative analyses were conducted using SPSS. Thematic coding of the qualitative data (Research Question 3) occurred through an inductive process of coding and theme identification. This analysis served as triangulation of the quantitative data and also offered greater insight into instructional practices that may impact need satisfaction, need frustration, and self-regulation.

Basic Psychological Needs Results

The Need Satisfaction and Frustration Scale (NSFS) was administered to students as both the pre- and post- test measure of need satisfaction and frustration. The pretests occurred in late September or early October of 2018 and the posttests occurred in March of 2019. The NSFS is divided into six subscales that are scored separately, with scores ranging from 1 (not at all true) to 7 (very true). The mean and standard deviation for satisfaction and frustration of all three basic psychological needs (autonomy, competence, and relatedness) are presented in Table 4. One-way repeated measures analyses of covariance (ANCOVAs) were conducted to analyze changes in pretest to posttest levels of each of the six subscales of basic psychological need satisfaction and need frustration,

while controlling for age, gender, and prior participation (see Table 5 for the results of the ANCOVAs).

The mean score for need satisfaction of all three constructs (autonomy, competence, relatedness,) were above four for both pretests and posttests, indicating that on average students' needs were met at the beginning of the school year as well as toward the end of the school year. The mean score for frustration of autonomy and relatedness was below four indicating that, on average, students' needs pertaining to these constructs were not frustrated at the beginning of the school year nor toward the end of the school year. The mean score for competence frustration on the posttests was above 4, indicating that students felt some degree of competence need frustration toward the end of the school year, which was in contrast to a slightly lower level of competence need frustration at the beginning of the year. However, the slight increase in competence need frustration from pre- to post- test was not significant. Nor were the changes between any of the other need satisfaction and need frustration constructs statistically significant (see Table 5). These results suggest that students' pretest levels of need satisfaction and need frustration were sustained over the course of the school year, as there were not significant increases nor decreases from pretest to posttest scores.

Table 4

Means and Standard Deviations for Need Satisfaction and Frustration

	Pretest		Posttest	
Variable	*M*	*SD*	*M*	*SD*
Need Satisfaction				
Autonomy	5.45	1.03	5.40	1.28
Competence	5.00	1.06	4.83	1.14
Relatedness	4.60	1.11	4.74	1.21

Need Frustration				
Autonomy	2.94	1.23	2.87	1.13
Competence	3.84	1.21	4.14	1.16
Relatedness	3.34	1.36	3.40	1.31

Note. Unadjusted means

Table 5

ANCOVA Need Satisfaction and Frustration

Variable	Λ	*F*	Hyp *df*	Error *df*	*p*	Partial η^2
Need Satisfaction						
Autonomy	.96	2.18	1	55	.15	.04
Competence	.98	1.04	1	56	.31	.02
Relatedness	.99	.32	1	57	.57	.01
Need Frustration						
Autonomy	.99	.81	1	56	.37	.01
Competence	.98	1.70	1	58	.30	.02
Relatedness	1.00	.51	1	56	.48	.01

Academic Self-Regulation Results

The Academic Self-Regulation Questionnaire (SRQ-A) was administered to students as both the pre- and post- test measure of academic self-regulation. The SRQ-A is divided into four subscales that are scored separately, with scores ranging from 1 (not at all true) to 4 (very true). The scales are also combined to produce the Relative Autonomy Index (RAI), ranging from -9 to 9. A negative score on the RAI indicates controlled regulation whereas a positive score indicates autonomous regulation. Both pre- and post- test RAI scores were positive, indicating autonomous regulation at both points of measurement. The means and standard deviation for each regulatory style, as well as the RAI, are presented in Table 6.

Table 6

Means and Standard Deviation of Self-Regulation

	Pretest		Post Test	
Variable	*M*	*SD*	*M*	*SD*
Relative Autonomy Index	1.38	2.15	1.11	1.95
Regulatory Style				
Extrinsic Reg.	2.63	.58	2.68	.54
Introjected Reg.	2.71	.56	2.71	.63
Identified Reg.	3.28	.47	3.20	.47
Intrinsic Motivation	3.01	.55	3.00	.55

Note. Unadjusted means

One-way repeated measures ANCOVAs were conducted to analyze the change in pretest level of academic self-regulation for each of the four subscales as well as the RAI, while controlling for age, gender, and prior participation. The results for all five ANCOVAs indicate no significant difference in pre- and post- test scores (see Table 7). These results suggest that students' pretest levels of academic self-regulation were sustained over the course of the school year, as there were not significant increases nor decreases from pretest to posttest scores.

Table 7

ANCOVA Academic Self-Regulation

Variable	Λ	*F*	Hyp. *df*	Error *df*	*p*	Partial η^2
Regulatory Style						
Extrinsic Reg.	.97	1.72	1	59	.20	.03
Introjected Reg.	.95	3.05	1	59	.09	.05
Identified Reg.	.99	.81	1	59	.37	.01
Intrinsic Motivation	.99	.70	1	58	.41	.01
Relative Autonomy Index	.98	1.19	1	58	.28	.02

Qualitative Data Analysis and Results

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The qualitative data was collected to supplement the quantitative investigation through school observations and student interviews. This investigation also helped to determine potential factors that may impact the effectiveness of environment-based education programs on influencing academic self-regulation, academic autonomy, perceived competence for learning, and relatedness in school (Research Question 3). These factors were used to identify variables for further research and to develop recommendations for further program development and implementation.

Data analysis of the 5 program observations and 17 student interviews, which represented 4 of the 5 schools, occurred by analyzing the notes through a general process of data organization and interpretation described by Creswell (2014). The process included organizing and preparing the raw data, reading through all of the data, coding the data and classifying them into themes, interrelating the themes, and interpreting the meaning of these themes. Tesch's "Eight Steps in the Coding Process" (as cited in Creswell, 2014) was applied to code the raw data. These codes were then sorted into descriptive themes which were determined complete when they displayed multiple perspectives, a detailed overview of the experience, and were supported by specific evidence (Creswell, 2014).

While coding these themes, it was important to note that a main purpose of the qualitative data focused on identifying actionable steps that could impact teacher practice. Because a rubric for environment-based education implementation already exists, it seemed important to identify what specific parts of this teaching strategy were different than other programs. The answers provided in the interviews corresponded with the

defining characteristics of environment-based education and the interviewees collectively agreed that their school was having a positive influence on academic self-regulation, need satisfaction, and need frustration. Thus, the qualitative data supports the quantitative data in adding evidence that the sustained levels of self-regulation and basic needs could likely be due to environment based education.

The following themes were generated from the analysis described above. Each point is followed by paraphrases of student responses and an explanation supported by observations to better illustrate each theme. Numbers and percentages are not reported because frequency was not the only criteria used to code themes. Additionally, these results cannot be generalized to an entire population and instead are to be used cautiously to guide further research and program implementation. With these considerations in mind, environment-based education programs appeared to satisfy students' basic psychological needs and sustain academic self-regulation when:

- **Students were not passive recipients of knowledge but instead applied their learning through hands-on, purposeful, and individualized experiences.**

> We make our own projects and it's not just going over one thing. Before (at my old school) everyone did the same thing. Now I can add on to my own project. (Male, 11th grade student)
>
> For a project, you have a ton of freedom. Someone recreated a huge map of battlefields. I'm making a video game. Those types of things you wouldn't learn in normal school. You couldn't just walk in and learn about technology. You're not limited to normal curriculum. Some things don't work and we learn from it and adjust so it works. We don't try to force things people are uncomfortable with, we make accommodations. (Male, 9th grade student).
>
> I changed how I learn and how I absorb information. I can choose any subject area and I absorb more information. It helps me learn something worthwhile. (Male, 12th grade student)

> This is hands-on. For example, if we were learning about ice fishing at our old school, they would have just told us about it. Here, we would go ice fishing and then dissect the fish...I love the outdoors and hunting so I'm doing a project about jerky production. I'm testing the moisture level by weighing it before and after it goes in the oven. (Male, 10th grade student)

Students were actively engaged in all components of their learning experience. The students were given the responsibility for their own learning by selecting project topics, developing goals, crafting an action plan, driving decisions and progress, and problem solving when obstacles arose. In several schools, students needed to explain how their projects met academic and sustainability standards. The tools were in place to help student learn to monitor their own progress through these projects. Systems such as skill rubrics, clear project guidelines, online progress tracking platforms, reflective journaling and collaborative planning helped students to identify their goals and stay on track towards completion.

A description of one school's teacher-led project on energy helps to explain the depth of the learning experiences. The school had solar panels but most of the school community didn't know how to read the collected data. This unit was designed to help them better understand this information and make more informed decisions in the future. To begin the unit, they tested different appliances and completed energy conversions to better understand utility bills. They then moved on to explore the differences between AC and DC as well alternative forms of energy. A board member has lived off-grid for 20 years, so the students toured his house to learn about upfront costs, long-term savings, and other factors that impact solar energy. At the end of the unit they had a choice in a hands-on experience where they could create a mini wind farm or a solar operated

oven. They planned to use these experiences to compare green energy to more common types of fossil fuels. Throughout the unit, students also had opportunities to design individual projects that contributed to the overall group understanding of different forms of energy. This overview highlights the depth, choice, and planning that comprised the majority of the learning experiences at the study schools.

The concept of freedom also arose repeatedly throughout the student interviews. Students highlighted the ability to study what they wanted, when they wanted, and to develop systems that worked best for them. It appeared that because students were so involved in all parts of their learning experience, they felt autonomous in their ability to make decisions related to their learning.

- **Learning occurred through a dynamic and supportive partnership between adults and adolescents**

> We've been building relationships and the community and district have been supportive. We've been offered freedom and growth because of the hard work from students and guidance from adults. We've changed the community for the better. (Male, 12th grade student)

> Here, teachers sit down with me and help me learn…The teachers are wonderful and do a lot to help us. (Female, 10th grade student)

> The teacher-student relationships are my favorite part. In traditional schools the teachers focus on the problem kids, so I rarely talked to my teachers. Here, my teachers don't look down on us and they make an effort to get to know us…It's a different way of interacting, (they're) not scary authority figures. (Female, 9th grade student)

> Everything is one-on-one (if we need it) …They aren't as strict here, but the rules they do have are fair. (Male, 10th grade)

> I don't just pick (seminar and teacher led project) topics I'm excited about. Instead I think about the skills my students will need to succeed once they are outside of the school walls. This often means that I have to learn alongside my students. Sometimes I start something and then realize it isn't working for the students, so I'll throw it out and find a new direction that better meets student needs. (Advisor, 19th year in education)

In contrast to a more teacher-centered relationship, where the teacher knows all and the student must absorb the rules and information, successful environment-based education programs viewed the student-teacher relationship as a learning partnership. Student input was valued and prioritized in these partnerships and students received scaffolded support that fluctuated to meet their individual needs. The advisors thought about the skills students needed to develop and were willing to find other experts or learn new material alongside the students. Students scheduled regular meetings with their advisors to discuss their progress and received additional help as necessary. They worked collaboratively with the staff and other students to develop systems of feedback and support. Students consistently attributed feelings of need satisfaction to their relationships with their teachers and advisors. This dynamic system seemed to help sustain students' perceived competence because students developed a diverse set of skills as well as multi-faceted support systems to help meet their personal learning goals. It also appeared to help students develop a sense of connection and community, which helped to sustain feelings of relatedness. Finally, because teachers worked with the students, students appeared to feel heard and validated and had a sense of control, or autonomy, during their school days.

- **Students had the opportunity to break traditional social boundaries with peers and community members**

Being part of something opened me up to be more open to people. I'm not as judgmental and it helps me to be more open to other ideas…I didn't like to talk to people. Through the capstones I had to contact someone (outside of the school). I needed a live resource and had to reach into the community and talk to new people. (Male, 12th grade student)

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We're way closer because we do a lot together. We have team activities. We don't leave people out and we're all friends. Even if you don't like someone, you're still nice to them. (Male, 6th grade student)

We're always together so we have a strong sense of bond. We're not peers, we're like a small family. We know each other as well (like a family). We welcome new people and learn to talk to people in different ways. We have many different, unique personalities. We learn how to interact with this wide variety which helps to connect with others in the future. (Female, 9th grade student)

Before, I had one or two "kind of friends." Here, there's an openness that feels like a second home. It feels safe. Everyone is equal and isn't afraid to talk to people. We have a community pool of knowledge. You have to talk to people to build people skills and be productive. (Male, 12th grade student)

By building connections on many levels between students, teachers and communities, program participants had the opportunity to expand their relationships and perspectives. All of the programs involved periods of time when students worked in groups of diverse age and skill range. Advisories were broken into multi-grade groups, giving students the opportunity to learn from and interact with a wide age of students. The schools had common rooms for collaborating, connecting, and relaxing which further helped to facilitate peer interactions. Multiple students noted that they often forgot the age of their classmates. This collaborative design more closely mimics the working world, where workers interact based on skills and shared goals rather than interactions that are isolated by age.

In order to develop the skills necessary for this type of work, each school used various strategies to facilitate group membership. At the beginning of the year, all of the programs focused on building relationships between students. One school had students create their "Social Commitments" to their fellow students, advisors, and community.

All of the students signed the commitments and the poster was hung on the main wall next to the commitments from previous years. Another school paired new students with a mentor student with similar interests and temperament. This relationship helped to develop the new student's sense of belonging and facilitated development of leadership skills in the experienced student.

Collaboration continued throughout the year through group struggles and team-building. All of the schools offered opportunities for multi-day outdoor trips where students needed to work together to succeed. Additionally, the schools used survival days to help students break barriers and work together to "survive" in various scenarios. Multiple schools used skill rubrics and social emotional learning curriculum to help students continue to develop interpersonal skills throughout the school year. This collaboration between peers appears to be important because it helped students see the value all individuals brought to the learning experience and decreased judgement of others, thus sustaining feelings of relatedness.

All programs also incorporated learning in the community through interactions with various community members and leaders. Students presented their work to the community multiple times a year. Every student was required to present and share their work, thus giving them an opportunity to interact with the community and demonstrate their achievements. The experience also helped to inform the local community of the important work happening at each school. This diverse makeup of learning partners appeared to help students see that everyone could contribute and collaborate within a community pool of knowledge which fostered students' feelings of relatedness.

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- **Students were empowered to personally define and achieve success**

  We're in charge of our education and we have to make decision to work and graduate. We actually experience decisions to succeed. (Female, 9th grade student)

  I wanted to come here because I could control what I learned, get a leg up on my career and I'm able to do the research I want. I wanted to write higher level papers so I did a senior capstone on writing styles. Coming here means you have to control your own learning, all the big decisions. You have to think about what you want to learn and manage the credits. (Male, 12th grade student)

  I always heard the phrase, "When I grow up I will…" but now I feel like I can actually do things now…I have to try and I'm challenged. I have to consider what the roadblock in my project is and solve it. Now I have problem solving skills. (Female, 9th grade student)

  We have an opportunity to work harder to get ahead…We have to align our projects to standards which puts more responsibility on me. The teachers used to do it, but now it's our responsibility. We also have to connect our projects to sustainability and community impact questions. (Male, 10th grade student)

  It helps get out of close-minded thinking. I'm more open. It's a realistic community. We hear to grow up and go out into the world, but now we can change things, we're not just drones. We're an individual. We learn how to be a person in a community…you get to know what you want to be. (Male, 12th grade student)

  We have Personalized Learning Days where we can work at school, home, or out in the community. I went in to the community center and played basketball, then I came to school and worked and then I volunteered at the Humane Society. Other students use the time to work at their jobs…we have to earn this…we have to meet our goals to have the freedom. (Male, 10th grade student)

Students were seen as autonomous individuals who were capable of charting their own courses to success. All of the schools operated on a shared set of student-driven guidelines that were rooted in responsibility, partnership, and respect. This system built trust and also helped to foster development and achievement of personal goals. Rather than always completing the same work as other students, or working towards external measures of success such as grades or prizes, students worked towards achievement of

personal goals and freedoms. These goals ranged from learning about a new topic of interest, early graduation, earning privileges to work from home, or having time off from the traditional school day to engage with the community through volunteer hours.

Students also learned to think beyond short-term goals and to view themselves as part of a larger system. Field days and field experiences brought students out of the classroom and into their local community. Unlike a traditional field trip which is often just an add-on activity or a fun reward, these experiences typically related to a larger unit of study. These experiences seemed to contribute to students' ability to visualize their potential impact on their community and to develop a belief in their ability to achieve lofty goals. Students consistently attributed feelings of autonomy and competence to the plethora of opportunities to "work harder," "get ahead," and "succeed." These comments seemed to point towards feelings of competence in setting personal, limitless goals and working towards successful completions of these goals.

These themes represent program characteristics that students identified as impacting satisfaction of basic psychological needs. The majority of programs shared these characteristics and essentially, they support the defining characteristics of environment-based education programs. In this way, the qualitative results support the quantitative findings that environment-based education sustains academic self-regulation and satisfaction of basic psychological needs. These findings are consistent with the literature on self-regulation and psychological needs as outlined in Chapter 2 and this alignment will be elaborated upon in Chapter 5. These findings are also consistent with previous studies on environment-based education and add to the depth of the existing

literature (e.g., Athman & Monroe, 2004; Lieberman & Hoody, 1998; NEETF, 2000; SEER, 2000).

Chapter 5

Discussion

Introduction

The goal of this exploratory research was to identify if participation in environment-based education influences two key components of self-determination: academic self-regulation and need satisfaction. In light of the typical decline of these constructs during the high school years, this study aimed to identify and better understand one potential approach to limiting this decline and sustaining levels of academic self-regulation and need satisfaction. Due to this study's small, homogenous sample results and the lack of a control group, the study was exploratory and should be interpreted with these limitations in mind. Additional limitations and suggestions for future research will be discussed at the end of the chapter. The results are first separated by quantitative and qualitative data and are then summarized and discussed through key conclusions and implications.

Discussion of Quantitative Data

The mean scores of the NSFS suggested general need satisfaction and limited need frustration. When controlling for covariates, the results of the ANCOVAs indicated no significant difference in pre- and post- test scores for both need satisfaction and frustration. In contrast to studies showing a decline in need satisfaction throughout traditional secondary education (Gnambs & Hanfstingl, 2015; Jacobs et al., 2002; LaGuardia & Ryan, 2004; Navarro-Paton et al., 2018), the results of the current study indicated no significant change in need satisfaction. Thus, these results, when combined

with results from the student interviews, suggest that participation in secondary schools that use environmental-based education may help sustain need satisfaction and need frustration, potentially helping counteract the typical decline. Although there is a lack of literature in which to base comparisons of need frustration, it is worth noting that in general students' scores on the NSFS indicated low levels of need frustration. These results warrant future analysis of the mechanisms that impact need frustration and its correlation to self-regulation.

When controlling for covariates, the results of the ANCOVA test indicated no significant difference in pre- and post- test scores for academic self-regulation subscales nor the combined RAI score. Thus, these results, in conjunction with the findings from the qualitative interview, suggest students' academic self-regulation was sustained during the duration of the study period. which is in contrast to what is typically seen in students at this age. Therefore, it seems possible that environment-based education may be having a positive influence on academic self-regulation.

Considering these results along existing literature, the data from this study support the premise that environment-based education programming may help sustain need satisfaction, need frustration and academic self-regulation. In *Improving Academic Achievement*, Deci and Ryan (2002) offer the following guidelines for teachers wishing to foster students' self-determination: provide constructive feedback without evaluating the person, offer meaningful rationale for activities and behavior, acknowledge students' feelings, offer opportunities for choice and optimal challenge, and create space for cooperative learning. Environment-based education capitalizes on these

recommendations and challenges students to learn in a way that mimics problem-solving outside of school and in effect may develop their understanding of the rationale behind learning. Additionally, using interdisciplinary, local issues as a context for learning helps root learning in reality and creates an authentic learning experience. By creating these personal connections, investing themselves in solving a problem, and developing a justification for the learning activities, the student is more likely to develop a greater sense of control and autonomy and internalize the rationale for learning (Deci et al., 1994; Dignath & Buttner, 2008; Garn et al., 2019; Ryan et al., 1992, Ryan & Deci, 2000; Taylor et al., 2014).

A combination of the data and existing literature, suggests the beneficial nature of environment-based education programming as not just a content specific teaching methodology but instead an example of a high quality instructional approach that helps to develop key components of students' self-determination. The following section reviewing the qualitative data will attempt to summarize some of the general mechanisms that contribute to these findings.

Discussion of Qualitative Data

The quantitative data suggest that quality environment-based education programs may help sustain academic self-regulation, need satisfaction, and need frustration. The qualitative data offer further insight into how these programs may differ from traditional pedagogical approaches. All of the program components that were highlighted in the interviews and observations are indicative of the foundational characteristics of environment-based education. However, it is worth noting that it appears that it is the

interpersonal development, connection, and choice, not subject matter, that truly seems to satisfy students' needs. These results point to a holistic approach to education that expands students' perspectives and increases their control, in effect satisfying basic needs and helping to sustain academic self-regulation.

These findings support the conclusion that environment-based education is more than an isolated lesson outside, but rather a systemic and dynamic change in practice. It is quite possible that a school could offer projects as a learning tool or engage students in their local environment without satisfying basic psychological needs. However, when implemented fully with commitment and partnerships, environment-based education programs appear to meet students' needs through a more complex web of practices that move far beyond simply teaching about the environment. Rather than looking for short-term solutions, environment-based education programs rely on consistent, flexible, research-based practices that prioritize the needs of the student. Many of the students compared their current schools to past experiences, which adds further support to the notion that EBE programs are doing something different and meaningful which in effect may support need satisfaction and academic self-regulation. In order to better understand these practices, and the supporting research, this section will connect each theme from the qualitative data with teacher practices and supporting self-determination research.

Theme #1: Students are not passive recipients of knowledge but instead apply their learning through hands-on, purposeful, and individualized experiences.

Existing research attributes low need satisfaction and intrinsic motivation in the classroom to factors such as low amounts of choice in the classroom (Patall, 2010) and pressure oriented language coupled with high levels of control (Garn et al., 2019). In

contrast, student choice appears to lie at the heart of all of the studied environment-based education programs. Student interview responses frequently included phrases such as "I love…so I'm studying it" or "I'm interested in this topic so I chose to do a project on it". In a study on factors affecting internalization, researchers found that emphasizing choice as well as acknowledging participants' feelings positively impact internalization of an uninteresting activity (Deci et al., 1994). The findings suggest that offering students ongoing input and involvement in decision making positively impacts their self-regulation.

Environment-based education programs also offer students the opportunity to study topics in depth, which allows them to create action plans, overcome obstacles, collaborate, and apply skills in methods reminiscent of those used outside of school. For example, when one school was learning about aquatic management, the students visited a hatchery, camped overnight, and then went to the Upper Mississippi Wildlife Refuge to see how management skills were applied in a real setting. Another project focused on prairie restoration. The students collaborated with the local park district to learn restoration practices, wrote grants, planned and purchased plants for restoration, and then began the restoration process.

Although these examples listed here involve natural, science-based learning, it is important to note that students talked about these experiences more so in terms of the relevance to their lives, rather than focusing on the outdoor learning. This focus on personal relevancy highlights an important characteristic of environment-based education: using the natural and community setting and the local environment as a

context for learning. In this way, the term environment is inclusive of all parts of the local community, not just the natural environment. This distinction is especially relevant for teachers who may wish to meet the needs of students by incorporating relevant learning, but do not have the same accessibility to wild, open spaces as the treatment schools in this study. By incorporating the local context through relevant projects, field trips, and collaborations, all teachers can incorporate this aspect of environment-based education into their classrooms.

Systems such as skill rubrics, clear project guidelines, online progress tracking platforms, reflective journaling and collaborative planning help students to identify their goals and stay on track towards completion of these projects. Students are also charged with the responsibility of aligning their own project to the standards, rather than the teacher sorting through and determining which lessons satisfy which standards. In this way, students take ownership for ensuring they are learning the required material and have a better understanding of why they are learning a topic. When students are given choice, perspective, and an opportunity to express individuality, they frequently show greater autonomy (Deci et al., 1994; Garn et al., 2019). Additionally, offering students meaningful rationale for an activity, helps them to internalize and integrate the experience (Deci et al., 1994; Ryan & Deci, 2000). This research supports the current study's findings that the integrated learning experiences, coupled with individualized methods of completion, help students connect topics and skills in a way that makes learning relevant, which in effect may help satisfy basic psychological needs and sustains academic self-regulation.

Theme #2: Learning occurs through a dynamic and supportive partnership between adults and adolescents

Student input is valued and prioritized through regular student-teacher meetings, flexibility, and real-time decision. The teachers do not dictate what the students must do, but rather partner with the students to offer guidance and support as the students chart their own path. Research attributes low autonomy and competence satisfaction, as well as controlled self-regulation in the classroom, to factors such as lack of interest from and connection to adults (Anderson et al., 1976) and lack of competence feedback (Dweck, 1985, 2006; Harter 1981b; Niemiec & Ryan, 2009). In contrast, in classrooms where teachers are supportive of students' autonomy, students have higher reported self-regulation (Gillett et al., 2012; Vallerand et al., 1997). Additionally, when students know that their perspectives matter, this makes them feel in control and valued, which helps to satisfy needs of autonomy and relatedness (Deci et al., 1994; Garn et al., 2019; Katz, 2016; Niemiec & Ryan, 2009). Therefore, these findings suggest that partnering with students to help them guide their learning can satisfy needs for autonomy, competence, and relatedness and in effect sustain academic self-regulation.

Theme #3: Students have the opportunity to break traditional social boundaries with peers and community members

Through multi-grade advisories, small schools and classes, and development of group membership skills, students have consistent opportunities to develop new and meaningful relationships. Environment-based education schools incorporate social emotional learning curriculum, teamwork activities like high ropes course and outdoor survival days, and collaborative group work on a consistent basis. Although many

traditional schools may incorporate one or two of these components, perhaps by visiting an environmental learning center, the implementation may not occur consistently. It is this frequent and consistent integration of group membership that sets environment-based education program apart.

Breaking traditional social boundaries may help students to see their own value and the ways in which they contribute to the group effort. Research attributes low need satisfaction and intrinsic motivation in the classroom to factors such as negative influence of peers (Ryan, 2001) and perception of lack of connection to others (Katz, 2016; Ryan & Grolnick, 1986). In contrast, when students have a sense of belongingness, their feelings for relatedness are met and in effect this creates a space for individuals to build competence (Trenshaw et al., 2016).

Theme #4: Students are empowered to personally define and achieve success

Students find motivation through their own personal goals and freedoms, yet at the same time they are part of a larger system. In the interviews, words and phrases such as "work harder," "get ahead," and "succeed" frequently surfaced. Instead of working towards grades or other extrinsic rewards, as typically occurs in school, students are consistently working towards their own goals of personal relevance. By connecting school to personal goals, students are demonstrating autonomous self-regulation. Although they may not be intrinsically motivated, or excited about everything they learn, they can see how their learning connects to the bigger picture of their lives. Some of the statements that point to the holistic, autonomous, and flexible nature of these programs, which contributes to integrated self-regulation, include:

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"Actual experiences on how to make decision, we're in charge of our own education" -9th grade student

"It's flexible and independent" -12th grade student

"It helps get out of close-minded thinking" -12th grade student

"I drive my own education" -11th grade student

Because the social context supports need satisfaction, through actions such as providing meaningful rationale for an activity, acknowledging students' feelings, and conveying a sense of choice in learning, the students are more likely to demonstrate identified or integrated self-regulation (Deci et al., 1994).

Additionally, when environment-based education programs use extrinsic motivators, they are typically coupled with feedback and options for autonomous choice. While extrinsic rewards are effective at cultivating motivation for a specific action at a given time, they have been shown to undermine intrinsic motivation and the internalization of extrinsic regulations (Deci et al., 1994). However, when coupled with competence feedback and offered in an autonomy supportive manner that includes student choice, perspective, and involvement, extrinsic rewards may also sustain self-regulation. The importance of coupling extrinsic motivation with autonomy supportive structure was evident in the qualitative data. For example, one school uses a classroom economy to motivate students to complete necessary school chores. However, rather than simply offering students a reward for completing a desired task, students receive a paycheck for completing required chores; pay taxes, rent, and interest; and can earn additional income by offering additional help. By structuring the extrinsic rewards

around a learning experience, where students must monitor their own progress and goals, this system may also help to develop students' self-regulation.

Implications

In summary of these themes and conclusions, the following four takeaways offer broad-scale implications for program practices:

1. *Environment-based education should be viewed as teaching philosophy rather than a content specific approach*.

Although environment-based education typically falls within the category of environmental education, and thus may be viewed as a science specific approach, its methods of instruction reach far beyond implications for outdoor learning or the science classroom. Instead, through research-supported instructional methods and pedagogy, environment-based education should be viewed as a beneficial teaching philosophy that crosses disciplines, individualizes education, and helps sustain academic self-regulation and basic psychological needs.

2. *Student choice and perspective are vital for need satisfaction and self-regulation.*

During the transition from middle to high school, students' priorities often shift to nonacademic activities or subjects that are not addressed in school (Wigfield & Eccles, 1994). This shift in priorities offers additional insight into why students' intrinsic motivation may decline throughout these years. As their interest in subjects outside of school increases, material learned in school seems to lack relevance and meaning. By incorporating students interests directly into the academic content, environment-based education may help to keep course content aligned with student interests, thus supporting

student autonomy and academic self-regulation. Educators can begin implementing these practices into their classroom immediately by focusing on building relationships with their students, facilitating group membership, and recognizing the importance of student voice and choice in the classroom.

3. *Program changes should implement holistic and consistent methodologies.*

The results of the current study highlight the importance of holistic program changes. The long-term solutions to complex problems lie in consistent approaches. Although it is much easier to look for short term or one-step solutions to educational problems, systemic change won't occur by taking students outside for a 30-minute lesson nor will it happen by ordering iPads for every student. Simply teaching an isolated environmental education lesson will not procure these same benefits as well-implemented environment-based education program. By looking beyond "quick fixes" to programming methods such as environment-based education, communities, educators, administrators, and policy makers can engage systems thinking and develop programmatic changes that shift school culture and achievement.

4. *The same practices must be modeled with teachers*

Although this study did not look at teacher needs, research has shown that autonomy supportive schools leads to autonomy supportive teachers, which in effect leads to the development of autonomy in students (Deci et al., 1982). In order to satisfy basic needs and develop self-regulation in students, teachers must receive training on best practices to do so and they must also work in environments that are supportive of their own needs.

Limitations & Directions for Future Research

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This section will address various limitations of the study with support and suggestions for future research. The criterion of feasibility was used in the initial screening of schools, which limited the search to schools within approximately five hours of Duluth. Using the 2016-2017 Wisconsin and Minnesota Public Education Report Cards, both of which were available publicly through the state's Department of Public Instruction and Department of Education respectively, a demographic report was generated for each treatment school. After reviewing the data, the researcher identified control schools based on similarities in the following characteristics: location, district, demographics, socio-economic status, school rating (WI) and state test scores. However, none of the identified schools were willing to participate in the study.

Therefore, due to the lack of a control group, it is not possible to state that the sustained level of academic self-regulation and need satisfaction is due to the environment-based education. However, when combined with the qualitative results, and in light of the typical decline seen in secondary students, it seems possible that the environment-based approach used in these schools is at least partially responsible for the sustained levels. Further, the homogenous sample makes generalizing these findings to more diverse schools and to other settings problematic. Nevertheless, the potential contribution of environment-based education in this small sample warrants further study.

Although the grounding literature indicates a typical decline in academic self-regulation and basic psychological needs, this is still a relatively small body of literature. Many researchers have documented the decline of intrinsic motivation, but fewer studies have analyzed the impacts of secondary schools on self-regulation. Based on the

literature supporting this more nuanced understanding of motivation (Rigby et al., 1992; Ryan & Deci, 2000; Ryan et al., 1992) and the assumption that not all components of school will ever be intrinsically motivating, further study of this construct is warranted. Longitudinal studies that include a control group and analyze the changes across grades, especially during the critical transitions from elementary to middle school and from middle to high school, would offer a more in-depth understanding of these constructs, especially in regard to the impact multiple years of programming may have on these constructs. For example, in the present study, students' scores in identified regulation and intrinsic motivation may have started out at a higher level than average due to the high percentage of students who were enrolled at the study schools for multiple years. Additionally, students chose to attend their respective programs, which may result in baseline differences in comparison to students attending traditional public schools.

Because students' self-report of constructs may have also influenced the validity of results, future research should look to limit this influence by using multiple measures to cross-validate results. Such studies could also strengthen the literature supporting environmental education and environment-based education programs. A literature review of published environmental education studies found that the majority of studies analyzed programs for an average of one to six months (Ardoin et al., 2018). Although a short-term study offers insight into the immediate implication of practice, a longitudinal multi-year study would offer a more nuanced understanding of long-term implications.

Student interview participants were selected by their teachers as "information-rich" individuals. Although these students did not need to be the "best" students, they did

need to understand the program and feel willing to talk with a stranger. This request may have impacted the final selections of participants of which only 3 of the 17 students interviewed were in grades 6-8. These selections may have also excluded students for whom the program did not work as well. Additionally, due to the specific structuring of the interview questions, which guided students towards what works in the program, few of the students noted aspects that were not working. However, interviewees frequently referenced that their current school was different from the prior school, which offers further evidence into the understanding that environment-based education may be offering students a different and beneficial experience in comparison to more traditional education programs. In order to gain a deeper understanding of program nuances, future studies should aim for a larger and more representative sample of student interviews.

A longitudinal study may also help to identify an optimal level of self-regulation, need satisfaction, and need frustration. Although this study showed promising results in both high levels of need satisfaction and low levels of need frustration as well as in sustained self-regulation and need satisfaction, as opposed to declining self-regulation and need satisfaction, it is worth further investigation to identify if and how these constructs can actually be increased. Gnambs and Hanfstingl posed a similar question and called for future studies to determine the optimal level of intrinsic motivation (2015). Potential considerations may include interventions that begin at an earlier age or longitudinal studies that apply and quantify this study's qualitative findings. Although all of the treatment schools implemented environment-based education practices in ways that appear to sustain basic psychological needs, the methods through which this is done vary

by program. It is therefore worth considering how these specific nuances affect psychological needs and self-regulation. It would be beneficial to further explore the characteristics identified by participants and see if based on program variation, one can identify differences in the levels of constructs. This will help to further identify which characteristics of environment-based education seem to be the most influential and also offer guidance for future program implementation.

The results of this study suggest a need-driven explanation for the decline in academic self-regulation. However further study of the correlation between constructs is necessary to support this suggestion. In line with other research (Gottfried et al., 2001; Lepper, 2005; Taylor et al., 2014) Gnambs & Hanfstingl (2015) identified a decline in intrinsic motivation in adolescents aged 11 to 16. When basic needs were met, intrinsic motivation remained stable. However, in contrast to Basic Psychological Needs Theory, which states that satisfaction of basic psychological needs facilitates internalization and integration (Ryan & Deci, 2000), this same study found that all external motivation styles were not associated with need satisfaction. Although outside of the primary focus of this current study, a correlation analysis between basic needs satisfaction and RAI indicated a statistically significant moderate correlation between satisfaction of each need and post RAI scores (see Appendix E). The results also indicated a correlation between satisfaction of one need and satisfaction of another need. The correlation was strongest between autonomy and competence satisfaction, which supports other self-determination theory research (Ryan & Deci, 2000; Williams & Deci, 1996). Correlation coefficients were also computed among frustration of each need and post RAI scores. Two of the six

correlations (Autonomy Frustration and RAI; Relatedness Frustration and Competence Frustration) were statistically significant. In general, these initial analyses highlight a need to further explore the connection between need satisfaction/frustration, RAI, and the individual components of RAI to further understand the role basic needs play in contributing to the development of autonomous regulation.

Without a control group, and with little grounding research on the longitudinal effects of secondary school on need frustration, it is difficult to draw conclusions regarding the need frustration outcomes. The study results show that students' mean need frustration was lower than the mean need satisfaction; however, there is not enough research to say how this compares to students' typical experience nor what impact it has on students' self-regulation. A longitudinal study of need frustration and its impact on academic self-regulation would help to answer this question and in effect would offer a greater understanding of how to meet students' needs throughout secondary education.

Although the ethnicity/race demographics of the sample are representative of the study population, they are not so of the country as a whole (U.S. Census Bureau, 2018a, 2018b, 2018c). Although basic psychological needs are universal (Hayamizu, 1997; Deci & Ryan, 2000; Schmuck et al., 2000), there is still research to be done on how these needs are satisfied across cultures (Iyengar & Lepper, 1999; Lepper et al., 2005 Zusho & Clayton, 2011). Therefore, expanding the scope of this study to include more representative demographics would aid in a better understanding of environment-based education's potential to help satisfy needs across cultures.

Conclusion

Amidst these study limitations, the results of this study are promising of the impact of environment-based education on academic self-regulation and basic need satisfaction. Returning to one of the opening quotes by Richard Louv, "An environment-based education movement-at all levels of education-will help students realize that school isn't supposed to be a polite form of incarceration, but a portal to the wider world" (2005, p. 226). Within this quote lies the heart and promise of environment-based education as a teaching philosophy that empowers students to create their own paths into the world. By implementing the strategies suggested through this research, and continuing to quantify the effects of programming, educators and researchers can continue to empower students through satisfaction of basic needs and sustained academic self-regulation.

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Appendices

Appendix A-Contact Letters

Initial Contact Email
Good morning,
I'm a graduate student at the University of Minnesota Duluth pursuing my Master's Degree in Environmental Education. I previously worked as a high school science teacher in Florida and while there became interested in the motivational power of learning through the environment and local community.

Throughout my first year of graduate studies, I found that current research shows that most students decline in academic intrinsic motivation throughout adolescence. Many researchers have hypothesized that various factors such as a low amount of challenge, low amount of relevance to student's lives, and an increased emphasis on performance rather than mastery in traditional schools may attribute to the decline in motivation. As you likely know, environment based education, works to counter many of these trends. However, little research has produced empirical data to support the effects of environment based education on student's academic intrinsic motivation and self-efficacy. Therefore, I would like to study these constructs for my graduate thesis.

The study will involve a questionnaire administered at the beginning and end of the school year as well as some class observation and small focus groups or interviews. I hope to find data that will further support the incredible work being done at your school! If you think _____ may be willing to participate in a research study next year, I would love to speak further regarding details of the study. Please feel free to respond via email or by phone at (715) 212-9616.

Many thanks,
Eva Robinson

Follow-Up Email
Good morning,

I wanted to follow up with you regarding my proposed research study about the effects of environment-based education on students' academic intrinsic motivation and self-efficacy. I would love to talk to you further about my proposed study and discuss the possibility of conducting research at your school. I've included the proposed timeline so you have an overview of the time commitment of this study.

Proposed Timeline:
May 2018: Confirm school approval to conduct research
First week of school: Students and parents sign consent/assent forms

Second/Third week of school (flexible to best fit school and student needs): Pre-test Students complete questionnaires (under 30 min)
Early March 2019 (flexible to best fit school and student needs): Posttest Students complete questionnaires (under 30 min) & possible follow-up focus groups
April 2019: Analyze data and share with schools

Please feel free to contact me with any additional question you may have via email or phone at (715) 212-9616.

Many thanks,
Eva Robinson

Appendix B-Consent and Assent Forms

University of Minnesota-Parent Consent to Participate in Research

Using Self-Determination Theory to Examine the Impacts of Environment-Based Education on Students' Basic Psychological Needs and Academic Self-Regulation

Student Researcher: Eva Robinson
University of Minnesota Duluth Graduate Student

Why am I being asked to take part in this research study?

In this study, we want to find out more about how various types of education affect students' psychological needs and the development of their self-regulation. You are receiving this form because you are the parent or guardian of student at one of the schools selected for this study.

What should I know about being in a research study?

- Someone will explain this research study to you.
- Whether or not your child takes part is up to you and your child.
- You can choose not to have your child take part.
- Your decision will not be held against you.
- You can ask all the questions you want before you decide.

Who can I talk to?

For questions about research appointments, the research study, research results, or other concerns, call the study team at:

Student Researcher Name: Eva Robinson Researcher Affiliation: University of Minnesota Duluth Phone Number: (715) 212-9616 Email Address: robi1164@d.umn.edu	Student Advisor: Julie Ernst University of Minnesota Duluth Faculty Email Address: jernst@d.umn.edu

This research has been reviewed and approved by an Institutional Review Board (IRB) within the Human Research Protections Program (HRPP). To share feedback privately with the HRPP about your or your child's research experience, call the Research Participants' Advocate Line at 612-625-1650 or go to https://research.umn.edu/units/hrpp/research-participants/questions-concerns. You are encouraged to contact the HRPP if:

- Your questions, concerns, or complaints are not being answered by the research team.
- You cannot reach the research team.
- You want to talk to someone besides the research team.

- You have questions about your or your child's rights as a research participant.
- You want to get information or provide input about this research.

How many children / parents will be studied?
We expect about 500 children will be in this research study.

What happens if I say "Yes, I want my child to be in this research"?

If it is okay with you and your child, and he or she agrees to join this study, your child will be asked to complete a questionnaire at the beginning of the school year and again in March. This questionnaire should take about 20-30 minutes.

Your child will also be asked to provide some demographic information including his or her gender, ethnicity and race, and grade level. Each student will receive a unique study ID number so this information will remain confidential.

What happens if I do not want my child to be in this research?
You and your child may decline to participate and it will not be held against you.

What happens if I say "Yes" but I change my mind later?

At any time, you or your child may contact the investigator and decide to withdraw from the study. If you withdraw, no more information will be collected from your child. You and your child will be asked if you wish for existing data to be included in the study or if you would like any and all data to be removed and not used in the study.

What happens to the information collected for the research?

The records of this study will be kept private. If we publish any article as a result of this research, we will not include any information that will make it possible to identify individual participants nor the schools they attend. All results will be presented as a summary, not at the individual level. Research records will be stored securely and no one will have access to the data other than me. The stored data will not contain identifying information and the data will be stored according to current University policy for protection of confidentiality.

Your signature documents your permission for you and the named child to take part in this research.

_____
Printed name of child participant

_____
Printed name of parent [ ] or guardian [ ]
to consent for the child to participate

_____

Signature of parent [ ] or guardian [ ] Date
to consent for the child to participate

_____

Signature of person obtaining consent and assent Date

_____

Printed name of person obtaining consent and assent Date

University of Minnesota-Assent to Participate in Research

Study Title: The Effects of Environment-based Education on Students' Basic Psychological Needs and Academic Self-Regulation

Researcher: Eva Robinson

Why am I being asked to take part in this research study?

A research study is usually done to find a better way to understand how things work. In this study, I want to find out more about how various types of education affect students' psychological needs and the development of their self-regulation. You are being asked to take part in this research study because you are a student at one of the schools selected for this study.

What should I know about being in a research study?

You do not have to be in this study if you do not want to do so. It is up to you if you want to participate and if you want to, talk to your parents or guardians about any questions or concerns you have about the study. If you decide you do not want to be in this study, no one will be mad at you. You can ask all the questions you want before you decide.

What happens if I say "Yes, I want to be in this research"?

If it is okay with you and you agree to join this study, you will be asked to complete a questionnaire at the beginning of the school year and again in March. This questionnaire should take about 20-30 minutes.

You will also be asked to provide some demographic information including your gender, ethnicity and race, and grade level. You will receive a unique study ID number so this information will remain confidential.

What happens to the information collected for the research?

The records of this study will be kept private. If I publish any article as a result of this research, I will not include any information that will make it possible to identify individual participants nor the schools they attend. All results will be presented as a summary, not at the individual level. Research records will be stored securely and no one will have access to the data other than me. The stored data will not contain identifying information and the data will be stored according to current University policy for protection of confidentiality.

Who can I talk to?

For questions about research appointments, the research study, research results, or other concerns, call the study team at:

Researcher Name: Eva Robinson Researcher Affiliation: University of Minnesota Duluth Phone Number: (715) 212-9616 Email Address: robi1164@d.umn.edu	Study Staff: Julie Ernst Email Address: jernst@d.umn.edu

This research has been reviewed and approved by an Institutional Review Board (IRB), a group of people that look at the research before it starts. This group is part of the Human Research Protection Program (HRPP). To share concerns privately with the HRPP about your research experience, call the Research Participants' Advocate Line at 612-625-1650 or go to https://research.umn.edu/units/hrpp/research-participants/questions-concerns. You are encouraged to contact the HRPP if:

- Your questions, concerns, or complaints are not being answered by the research team.
- You cannot reach the research team.
- You want to talk to someone besides the research team or your parents.
- You have questions about your rights as a research participant.
- You want to get information or provide feedback about this research.

Signature Block for Child Assent

_____

Signature of child Date

_____

Printed name of child

_____

Printed name of person obtaining assent Date

_____

Signature of person obtaining assent

Appendix C-Summary of Treatment Schools

	Jane Goodall Env. Sci Academy	Northern Lights Community School	Northern Waters Environmental School	Vermillion Country School	High Marq Environmental Charter
Location	Maple Lake, MN	Warba, MN	Hayward, WI	Tower, MN	Montello, WI
Pretest	Sept 14th, 2018	Sept 18th, 2018	Oct 2nd, 2018	Sept 24th, 2018	October 15th, 2018
Posttest	March 19th, 2019	March 25th, 2019	March 27th, 2019	March 13th, 2019	March 11th. 2019
Number of Students	108	85	40	75	32
Students in Study	18	18	9	1	19
% of School Population	16.67%	21.18%	22.50%	1.3%	59.38%
Grades	6th-12th	6th-12th	6th-12th	7th-12th	7th-12th
Years in operation	4	13	7	6	9
District/ Authorizer	Innovative Quality Schools	Audubon Center of the North Woods	Hayward Public Schools	Audubon Center of the North Woods	Montello Public Schools
Mission or Vision	Provide students with a diverse, rural landscape where they will be supported in pursuing their passions and grow to address the challenges of protecting our land, water and all of the environment.	Northern Lights Community School will create a safe, small and enthusiastic learning community in which all students are known well, taught as individuals, and encouraged to be good stewards of our environment.	Project-based learning community in the Hayward Community School District where students explore their natural, economic and cultural environment to foster collaboration, communication, creativity and critical thinking. With educator and partner support, students develop the skills and confidence needed to achieve in all academic areas.	Developing successful adults with the skills to enrich their communities and environment. To create a small, safe, nurturing learning environment where students become productive and engaged citizens.	Take a real-world approach to learning with hands-on experiences. Provide a safe and supportive classroom community. Maintain a 16:1 student-teacher ratio. Raise achievement in core subject areas through independent project-based learning. Teach the 4 Cs of 21st Century Skills. Give students and parents another choice in education

Appendix D-Completed Rubrics from School Observations

School name & location: **Date & time of observation:**	**High Marq Environmental Charter School; Montello, WI** March 11th 12:00-3:30			
Overview of School	High Marq Environmental Charter School serves approximately 30 students in grades 7-12. They are in their 9th year of operation. The school is part of the Montello public school district and shares facilities with the traditional high school. As a part of the Montello School District, High Marq receives funding and support from the school district. High Marq occupies two classrooms on the far end of the High School building. Each room houses an advisory although students move freely between the rooms. A typical day includes an advisory meeting, individual project work time, optional electives at the traditional school, Math, English, and meetings. Optional electives include band, choir, and driver's education. The students engage in one scheduled hour of PE each week and they must log an additional 225 hours of physical activity in order to earn the required 1.5 credits for graduation. During the first week of the month, the students complete the pacer-test and then participate in a student-led activity. On the second week, Ms. Bolan leads the students in yoga. On weeks three and four, the PE committee leads the activities.			
	1-Rarely Uses	**2-Occasionally Uses**	**3-Often Uses**	**4-Consistently Uses**
1) **Integrated interdisciplinary instruction** used to teach **academic content standards**				
Provide students with the opportunities to explore connections between subject area disciplines and among natural and social systems	Students have the opportunity to choose their own project topics. However, each new project begins with a written proposal that must include a justification for the project and the students must explain how it relates to sustainability, various subject areas, and learning targets. Although students may not focus specifically on environmental concerns, they need to analyze their projects through a sustainability lens. Additionally, they typically connect their projects to local and individual interests.			**4**
Coordinate students' learning between subject areas and class periods	The students are split into two advisories which include a mix of all seven grades. Some examples of projects that cross subject areas include: ● Creating a graphic novel about childhood trauma ● A capstone on the effects of various natural disasters (earthquakes, hurricanes, flooding) ● An Aldo Leopold Reading at a local cafe ● Conservation Hall of Fame Interviews & Showcase ● A multi-year project on training and raising therapy dogs Math is the one subject that does not appear as integrated into the project and other learning areas. Although students can connect math through their projects, they typically learn individually through an online math platform.			**3**

Cross traditional disciplinary boundaries to develop comprehensive understanding of natural and socio-cultural systems	Students cross boundaries through projects, field days, and community events all of which are explained in greater detail throughout the rubric. An example not mentioned in other areas of the rubric is the use of Lucy Calkins Units of Study for ELA to teach about social issues and engage students. January-March they had social issues book club. Some of the groups focused on topics such as Identity and the Black Lives Matter Movement. In March they are reading and writing their own poetry though a classroom version of March Madness.	**4**
Create a continuum of learning that crosses grade levels and allows students to conduct multi-year research and service learning projects that contribute to their community	In high school, the students must complete a capstone project to move to the next grade. Like the other projects, they can choose the topic. They may also pick a theme and work on various aspects of that theme each year. For example, one student did a multi-year project on video games. The first year he focused on how to create video games and the second year he looked at the connections between videogames and violence. Students use "genre pieces" as a way to show what they have learned. These pieces used to be just scientific papers, but now there are various ways to demonstrate learning such as creating a product, incorporating art, or writing creative pieces. As freshmen they need three genre pieces. This number increases until senior year when the students must have six genre pieces. For example, a different student focused on video games and the brain during his junior year. He invented "BrainCon" an Educational Gaming Convention and created various pieces to support the hypothetical convention. He also wrote an argumentative paper examining both sides of people who are both for and against educational games.	**4**
2) Combination of **independent & cooperative learning**		
Facilitate students as they form teams to work on projects and investigations	Students have the option to join various committees to engage in diverse interests. They can also choose to complete group or individual projects.	**3**
Ensure that student teams include a wide range of learning styles and ability levels	This component was not observed. Students appear to choose their teams and advisories based on their personal interest, with advisors intervening only to help facilitate dialogue in the event of major disagreements.	**1**
Help students develop group membership skills	Each year, students collaborate to create a social commitment poster outlining their values for the year. They all sign the poster and hang it on a wall that includes all of the previous year's posters. The advisors and students take conflict very seriously and work to develop dialogue and negotiation skills. Numerous students referenced the importance of being open and accepting to new and different people. Observing during the lunch hour showed obvious effects of this work. During lunch the teachers are eating and chatting together while kids mill about and interact with both one another and the teacher. The space is	**4**

	open and comfortable. Some students are drinking tea they made in the mini-kitchen. A chore list on the wall identifies individual responsibilities that help keep the space clean and tidy. During individual work time, a student asked to switch rooms where the light was dimmer. Ms. Bolan instead checked in with all of her students and simply adjusted the lights in their room. The students said the school feels like a big community where different walks of life can come together to be friends.	
3) **Collaborative instruction** connects teachers, parents, students and community members		
Involve students and community members in planning and instructional delivery	Students are heavily invested in their project topic choices. They also collaborate with community members to work on projects. At first, there was some community backlash against the school because people thought of it as the "delinquent school". But the teachers and students worked to build relationships and impact the community in a positive way and now the community and district are supportive of the school. One example of an ongoing positive impact in the community occurs through the leadership and planning of Family Adventure Day, an annual community event that provides hands-on, family friendly, experiences. Students are also required to include a "live" source for some of their projects which encourages them to connect with community members about various topics.	**4**
Provide opportunities for teachers to model positive team relationships	The two advisors are consistently interacting with their students, helping them solve problems, and guiding the students in the development of their projects. The school has an unspoken rule to ask for help and to offer help. Whether it is in the form of teacher-student, teacher-teacher, or student-student, asking for help is encouraged in order to help individuals progress faster.	**4**
Allow teachers to have regularly scheduled team meetings	There are two teachers, each overseeing an advisory, and one additional faculty who handles secretarial work and occasionally substitute teaches. The three staff eat lunch together and meet regularly after school. Teachers attend the annual No Teacher Left Inside training in order to develop skills, resources, and partnerships	**4**
4) Learner-centered, constructivist approach		
Take into account students' individual learning styles, multiple intelligences and cultural background to ensure effective instructional design practices in the context of the local community	Students work independently on some of their projects, sustained silent reading, and an online Math program called ALEKS. In order to earn credit, they must log all of these hours and complete various milestones each week. Student can log project work hours at home as well as during scheduled class time. A credit conversion chart helps students see how many hours they must dedicated to a project in order to earn graduation credits. Students meet one-on-one with an advisor on a bi-weekly schedule to ensure they are staying on track.	**4**

<table>
<tr><td>Assist students as they initiate self-directed courses of study</td><td rowspan="4">The Hawk Cycle is used to help students determine if they are behind, on track, or ahead in various areas include math, projects, field journal, chores, and attendance. Depending on their spot in the cycle, there are various supports to help them excel:
Egg (Behind):
● Distraction free zone, skills assistance, math table assistance, time log assistance
Hawkling (On Track)
● Group work time or IMC work time option for 1 hr 20 min, reading and working time outside
Hawk (Ahead)
● Unlimited group and IMC work time, off campus lunch, reading and working time outside

As long as students can justify their projects, they are free to conduct projects on any topic of choice. For example, one active member of the Future Farmers of America (FFA) is completing a project on the impacts of organic farming regulations on local farmers. As an owner of a dairy herd, this project is of particular relevance and interest to the student.
Other projects include:
● A student wanted to improve his writing ability in preparation for college so he did a capstone project on various writing styles
● Bicycle maintenance

Students may also take electives at the traditional school or choose to take online college courses towards the end of high school in order to obtain college credit.</td><td>4</td></tr>
<tr><td>Allow students to construct their own understandings</td><td>4</td></tr>
<tr><td>Provide students with opportunities to pursue authentic issues of personal interest to them</td><td>4</td></tr>
<tr><td>Support students as they define specific learning goals and objectives</td><td>4</td></tr>
<tr><td colspan="3">5) Problem-, Issue-, Community-based investigations encourages active involvement in a civil society (service learning opportunities)</td></tr>
<tr><td>Provide students with opportunities to investigate real-world community problems and issues</td><td>Outside of student projects, Field Day also allows students to engage in real-world community problems and issues. Everything is hands-on which involves the student in learning how to make real-time, real-life decisions. On Field Day, they work in field teams with field bosses who are field corps members who come in and help the students. The students use snapshot WI to monitor the school forest with cameras. They replace the camera chips and gather the data.</td><td>4</td></tr>
<tr><td>Encourage use of higher-level thinking and creative problem-solving skills to achieve comprehensive understanding of the complexity of real-world problems and issues involving the interaction of their natural surroundings with diverse cultural, economic, and</td><td>Students participate in annual survival days where they must combine higher-level thinking and creative problem-solving skills to “survive” in the school forest. They work in teams and plan where they will build their base camps, fires, and shelters. They then build these survival components and cook their own food. They receive points for each task as well as for maintaining a positive attitude. At the end of the day, they journal about what went well and what they will change for the second part. On survival Day 2 they finish their structures and also deal with “emergencies” such as burns and broken limbs. They learn the STOP principle (Stop, Think, Observe, Plan) to make safe decisions. This is a principle that can be applied to many situations.</td><td>4</td></tr>
</table>

political perspectives and interests		
Support students as they undertake and monitor service-learning activities	Students have biweekly meetings with their advisor and also meet frequently with their committees and teams. These meetings serve as a check-in and allow the students to build supportive relationships. It also gives the advisors time to individually monitor students and offer the necessary guidance.	**4**
Require students to reflect on their service-learning activities and communicate their findings to classmates, teachers and other appropriate audiences both inside and outside of their community	Students frequently use journaling and collaborative planning to reflect on their experiences and create plans for moving forward. They hold three community presentation nights a year where students share their projects. The school also has a Facebook page and students take turns writing updates about projects and events to share with the community. The students also participate annually in the WI Green Schools Network Youth Summit.	**4**
6) Using Natural and Community settings, the local environment, as a context for learning		
Uses local natural and community settings as a context for standards-based instructions	Students must connect each of their projects to WI academic standards and subject area learning targets. The students learn in their local and natural community at least once per week.	**4**
Develops students' understanding of natural and socio-cultural systems	In order to learn more about their impact on the natural world, within the classrooms students have a recycling and compost center as well as a large selection of field guides to guide exploration on field days. Students also learn in a realistic community that mimics interactions outside of school. One students said, "We hear that we should grow up and go into the world, but now we can change things (and don't have to wait). We're not just drones. We're an individual. We learn how to be a person in a community, not a standoffish worker. You get to know what you want to be."	**4**
Incorporates the community's cultural characteristics	On field days, students engage with their local community. On a recent field day, students visited local horticulture business. They met with a nursery owner and learned about how he runs the nursery and meets his goals. For lunch, they visited a local park and had P.E. After lunch, they went on a mindful walk through the forest. In the afternoon, they visited a local aquaponics business. They learned about the symbiotic relationship between fish and plants. Another example occurred with a field trip to The Midwest Renewable Energy Association (MREA). They learned about solar panels, wind turbines, and insulation. They then had to make model homes that were well insulated to keep a "family" of Jell-O unsolidified. The took the houses outside and checked them every	**4**

	10 minutes to monitor progress.	
Offers students opportunities to apply skills and knowledge in local settings	The students collaborate with community groups to complete projects. They've created blueprints, given presentations, and helped groups take action. Some focuses have included: planting trees, clearing brush, building a local boardwalk and helping local kids build bird houses. They also work with local agencies to provide the leadership for an annual Family Adventure Day which is a community-wide event that connect various organization to provide a day of exploration for local families.	**4**

School name & location: **Date & time of observation:**	**Vermilion Country School; Tower, MN** October 1st, 2018 12:00-1:00 March 13th, 2018 12:00-2:00			
Overview of School	Vermilion Country School is in its sixth year of operation as an independent school district in Northern Minnesota. The school is authorized by Audubon of the North Woods. They are part of the EdVisions cooperative which helps charter schools manage HR tasks. Approximately 40 students are enrolled at the school. The school is set up in a large building with sectionals separating each advisory. Within each section, tables are set up in pods for collaborative learning. The students turn-in their phones for the majority of the day, with access only allowed during lunch. Students are divided into teams to complete school "chores" such as lunch clean-up and composting. The school is teacher-led, with each teacher specializing in a subject and taking on various administrative duties. On Mondays, Tuesdays, Thursdays and Fridays students attend classes focused on various subject areas, have time to meet in advisory, and also have independent work time. On Wednesdays, they focus on environmental education topics in the morning and social emotional learning in the afternoon.			
	1-Rarely Uses	**2-Occasionally Uses**	**3-Often Uses**	**4-Consistently Uses**
1) **Integrated interdisciplinary instruction** used to teach **academic content standards**				
Provide students with the opportunities to explore connections between subject area disciplines and among natural and social systems	On Wednesdays students spend the morning outside or on field trips engaged in their local and natural community. These experiences are connected by an environmental theme that changes each year. Last year they focused on waste management and participated in field trips to a water treatment plant and made a plan to reduce school garbage. The experience culminated with an expo day for the community. This year, the focus is "Animals of the Northwoods". They launched the program on the first day of school with visitors from the zoo, an animal			**3**

Coordinate students' learning between subject areas and class periods Cross traditional disciplinary boundaries to develop comprehensive understanding of natural and socio-cultural systems Create a continuum of learning that crosses grade levels and allows students to conduct multi-year research and service learning projects that contribute to their community	rehabilitation center, and a paddling experience. These experiences are designed to be fun and engaging to get students excited about what they'll be studying and help them to feel more comfortable in new situations. Throughout the year they have participated in experiences such as meeting with a bat specialists, learning about aquatic invasive species, and exploring the area around the school yard to learn more about local species. Sometimes the teachers lead various activities based on Project Learning Tree and Project WET, which are DNR produced environmental education curriculum. Students are mixed by grade level and rotate through the different stations to gain further understanding about that day's focus. The students also engage in nature journaling on a regular basis to further their individual understanding of the local place (See #6 for more information). Physical education is often integrated into these outdoor experiences and has included snowshoeing, camping, and creating animal tracks in the snow. Outside of these field experiences, teachers seem to teach their subjects in relative isolation. They do try to overlap some of the reading focus with current topics. For example, when they were learning about winter survival they also read *Call of the Wild*. When the students were learning about birds in science, they also read articles about local birds and built their own bird nests.	
2) Combination of **independent & cooperative learning**		
Facilitate students as they form teams to work on projects and investigations Ensure that student teams include a wide range of learning styles and ability levels Help students develop group membership skills	On Wednesday afternoons the students participate in "Overcoming Obstacles" with their advisory. This free curriculum teaches social emotional learning skills, discipline, and communication. Students used to participate in more individual projects at younger ages, but the staff felt that they hadn't developed the necessary skills to regulate their own learning. They use this curriculum to help students develop these skills and build up to more independent learning later in their school years. As students build skills, they receive more independence. They have more opportunities for individual projects in their junior and senior year. On a daily basis they work independently and in groups as they rotate through classes. During field experiences they work in groups and also have time to visit their place (see #6) and record phenological observations.	**4**
3) **Collaborative instruction** connects teachers, parents, students and community members		
Involve students and community members in planning and instructional delivery	Students interact with the community on Wednesday field trips. As students progress, they have more opportunities to facilitate their own learning. Parents fill out a yearly survey offering feedback to help staff make changes in the upcoming year. Staff meet weekly to talk about student participation levels, engagement and achievement. This allows them to build a collective knowledge about student needs.	**3**

Provide opportunities for teachers to model positive team relationships		
Allow teachers to have regularly scheduled team meetings		
4) Learner-centered, constructivist approach		
Take into account students' individual learning styles, multiple intelligences and cultural background to ensure effective instructional design practices in the context of the local community	The school has a staff member who works specifically with Native Students. They have found that these students look at school differently and often have additional needs. The staff member works one-on-one with these students to help them develop an individualized plan that highlights specific areas in when they need to focus. She has also worked to incorporate aspects of tribal history and culture into other topics. The school has a positive behavior incentive program. Students who meet academic and attendance goals are rewarded with an additional special field trip at the end of each quarter. The last quarter trip involved a day of skiing at Giant's Ridge (a local ski hill). Outside of the required standardized tests, staff rely on authentic measures of progress in their classes and use few formal tests to assess learning. Students who score under a certain percentile on standardized tests for math and reading participate in direct services to help them improve these skills. Students who are proficient in these areas use this time for additional project-based environmental education learning. Students have opportunities to engage in electives such as music and theater. In theater, the students make their own choices about how to participate. Two of the students are planning their own musical while other students are designing the set.	**3**
Assist students as they initiate self-directed courses of study		
Allow students to construct their own understandings		
Provide students with opportunities to pursue authentic issues of personal interest to them		
Support students as they define specific learning goals and objectives		
5) Problem-, Issue-, Community-based investigations encourages active involvement in a civil society (service learning opportunities)		

Provide students with opportunities to investigate real-world community problems and issues Encourage use of higher-level thinking and creative problem-solving skills to achieve comprehensive understanding of the complexity of real-world problems and issues involving the interaction of their natural surroundings with diverse cultural, economic, and political perspectives and interests Support students as they undertake and monitor service-learning activities Require students to reflect on their service-learning activities and communicate their findings to classmates, teachers and other appropriate audiences both inside and outside of their community	Students have a community service requirement for graduation. Some students help monthly with the local food shelf to help unload boxes, stock shelves, and clean up. Others help with clearing land in the nearby area. Vermilion partners with area community groups to offer immersive community experiences for the students. Some of these have included: ● Visiting Hawk's Ridge in Duluth to deepen learning about hawk migration ● Brining in a local naturalist and Duluth Zoo staff ● Northern Tier High Adventure Base: three day, two night winter camping exploration. ● Canoeing near campus ● Visiting the Duluth zoo and receiving a behind the scenes tour ● Visiting the North American Bear Center in Ely ● Visiting the Ely Wolf Center ● Working with local trappers to obtain a trapping license Students do not seem to be working towards investigating or solving a collective problem. Although they are learning through real world experiences, they could be more active and engaged in these experiences.	**2**
6) Using Natural and Community settings, the local environment, as a context for learning		
Uses local natural and community settings as a context for standards-based instructions	Students are immersed in their local natural community through weekly field experiences. See above for details on some of these experiences. Students use a field journal to record observations during field experiences each Wednesday. They use consistent	**3**

Develops students' understanding of natural and socio-cultural systems Incorporates the community's cultural characteristics Offers students opportunities to apply skills and knowledge in local settings	formatting to ensure students are developing observation skills and recording key information from the experience: ● What did they find? Common name/scientific name ● Description/picture ● Label parts ● Describe habitat ● Link to biology In addition to recording notes and findings from group learning, students also have their own individual place on the property which they visit frequently to engage in nature journaling. They record phenological observations and at the culmination of the year will look back at how the space has changed over time. They will also need to examine an environmental issue and determine how it will affect the space.	

School Name & location:	**Jane Goodall Environmental Sciences Academy; Maple Lake, MN** **9/14/18 12:30-3:00** **3/19/18 10:45-3:00**
Overview of School	JGESA is currently in its 4th year of operation. They have 19 staff members: 10 licensed teachers, 8 paraprofessionals, and Jackie, the office staff. Jackie was my main point of contact and offered much of the insight included in the rubric. Three of the four special education teachers have master's degrees. The school is located on 300 acres of land. In the summer, the space is used for Camp Courage. The office building is the only building that stays throughout the winter. Here they have an office, conference room, library, maker space and science lab. The general schedule of the day begins with an advisory meeting and then includes project work-time, reading, and additional exploration of topics including environmental learning and team building activities. Students are asked to complete 45-60 minutes of independent math learning through Khan Academy each day. The charter school is authorized through Innovative Quality Schools (IQS). They oversee the school and serve as a form of checks and balances. JGESA is also a part of EdVision which is a co-op to support 18 charter schools. They participate in roundtables and share Human Resources and benefits support. The company Designs for Learning helps with Special Education onsite 1x a week. JGESA annually participates in the Hope survey, which measures Engagement levels, Intrinsic Motivation, School Climate and Belonging, Academic Readiness, and Hope (Agency and Persistence). In each year of participation they have seen an overall increase in scores. They also conduct regular parent and student satisfaction surveys. The most recent results indicate that 90% feel safe, enjoy the school, and feel that the school communicates well.
	1-Rarely Uses **2-Occasionally Uses** **3-Often Uses** **4-Consistently Uses**

1) **Integrated interdisciplinary instruction** used to teach **academic content standards**		
Provide students with the opportunities to explore connections between subject area disciplines and among natural and social systems **Coordinate students' learning between subject areas and class periods** **Cross traditional disciplinary boundaries to develop comprehensive understanding of natural and socio-cultural systems** **Create a continuum of learning that crosses grade levels and allows students to conduct multi-year research and service learning projects that contribute to their community**	Instead of classroom, classes take place in one of three cabins. Each cabin has approximately 2 advisories with 20 students each. Each advisory has a core instructor who works to oversee student projects and ensure standards of instruction are met. Additionally, each cabin staffs approximately 3 paraprofessionals to assist in students meeting their goals. Students design their own projects and use these as a grounding space to connect various topics. They must connect each project to academic standards, including environmental education standards. Examples of interdisciplinary projects: • Creating the school library • Fish tanks in the office (design, choose fish, monitor, clean) • Seine netting at the beach and comparing data across days • School doesnt have hot lunch so the kids put together a project to obtain healthy vending machines • Gravel path always floods with runoff so they paved it and are building a rain garden • Examining how various types of oil extraction affects the environment • Creating a periodic table quilt • The physics of skiing One example of a yearly opportunity to explore these connections occurs during the annual fishing tournament. The students must create a learning project surrounding the competition. One student taught about aging fish and compared the scales on the fish to the rings on a tree. Students are also required to complete a writing portfolio which must include at least 15 pieces of writing. The pieces can be parts of other projects that are then compiled as a showcase of the students' ability to write in various styles. With the help of the advisor, students work through the writing process on each piece of writing. The school developed a relationship with Seahorse Key Marine-Academy of Environmental Studies in Florida. Last spring, students visited the academy and learned about the marine ecology of Florida. Students have synthesized this information through a booklet identifying plant, land animals, and marine animals frequently found in the area. In an effort to strengthen this relationship and expand learning, students are returning this year. Since this experience didn't occur during my observation, I visited the Facebook page to learn more. Included is a quote from one of the chaperones: "We saw a pod of dolphins today. And the birds are amazing! Also, we went out with a herpetologist last night to look for cottonmouth snakes and we found one. We went trawling yesterday and are going seining in a few minutes. We'll share pictures when we can. Our group has been asked to come back next year! We have made so many connections down here-with UF, Florida Fish and Wildlife, the school in Crystal River and researchers."	**4**

2) Combination of independent & cooperative learning		
Facilitate students as they form teams to work on projects and investigations **Ensure that student teams include a wide range of learning styles and ability levels** **Help students develop group membership skills**	Students are assigned a space to work, with no more than two students at a table. They are responsible for identifying if this arrangement works for them and if not, they need to meet with their advisor to adjust their arrangements for optimal learning. One advisor summarized this process as "I, We, You". The responsibility may start with the adult, but then they can collaborate and decide what works best for the individual. Or it may start on the opposite end and when the student cannot handle the freedom, its turned back to the advisor. The continuum always exists, which creates a built-in support to help students develop the indepence necessary for project-based learning. Students facilitate the development of their own learning teams. However, they are given multiple opportunities to form teams through projects, committees, or field trips. Juniors and Seniors have the opportunity to participate in a nine-day overnight camping trip where a staff member facilitates students as they develop skills necessary to partake in the experience. Through staff collaborations, student advocacy, and a focus on building a family, the students learn to include one another in the group and work together. In order to help develop social connections, the staff pairs new kids with a mentor with similar temperament to help them make friends and find their place in the community. One piece of evidence of the development of group membership skills occurred when a student transferred from a school where he was placed in a specialty classroom. When he arrived at JGESA the mom wanted him included in the regular school day. The kids never had to be asked to include him in their groups. When he was running late, everyone waited for him. They picked him to be part of the team. The kids don't care, they're all here and nobody is left out. Students are only allowed to use personal technology such as cell phones during lunch. On Tuesday, they are not allowed to use any personal technology. These rules are in place to help encourage social interaction.	**4**
3) Collaborative instruction connects teachers, parents, students and community members		
Involve students and community members in planning and instructional delivery **Provide opportunities for teachers to model positive team relationships**	Students and staff interests help drive project and instruction topics. For example, in 2017 the IT Teach staff member, who has a strong interest in photography, taught the students how to take pictures on an especially beautiful day. The kids voted on the best photos and these are printed and displayed in the office. They have a few parent info nights a year to help keep parents informed. Parents are also involved through the parent group Partners in Education as well as the special ed advisory board, which community members can also join. The board overseeing the school must include at least one community member. Two of the staff members regularly attend local town Chamber Meetings. At some of these meetings they are	**4**

Allow teachers to have regularly scheduled team meetings	given the space to offer school updates, progress, and upcoming events. Multiple times throughout the year, the school hosts project nights where students display the results from one of their projects. They set up an exhibition and invite family and community members to attend the showcase. Representative Tom Emmer visited the school last spring, which gave the staff and students an opportunity to share their experiences from the Seahorse Key trip. The school is teacher led so the teachers wear a lot of hats and collaborate frequently. They have scheduled weekly meeting in order to help facilitate collaboration. Most of the staff has been there since the school opened which creates staff continuity. The students call their teachers by their first name and develop personal relationships with them. There isn't a hierarchy but instead they are all equals. Many staff members mentioned how the school is like a family. The school hosts family style potlucks with the staff and students. Last year, some of the students grilled the fish they had caught earlier in the week and shared it with the school. Another example of the positive relationship building occurred when a student with a thick discipline record was accepted to JGESA. After 2 ½ years at the school, he has had no discipline incidents. When the staff called to tell mom about this huge gain, she was so excited because it was the first time she wasn't called for trouble.	
4) Learner-centered, constructivist approach		
Take into account students' individual learning styles, multiple intelligences and cultural background to ensure effective instructional design practices in the context of the local community **Assist students as they initiate self-directed courses of study** **Allow students to construct their own understandings** **Provide students with opportunities to pursue**	Discipline occurs through restorative practices and relies on relationships. The staff said that because of the relationships they build with students and parents, they can have the difficult conversations together and find solutions. JGESA is working with their charter school authorizer IQS to develop additional forms of assessment outside of standardized testing. They are working towards creating a portfolio assessment to allow students to compile and construct their own demonstration of mastery. Currently, students are assessed through completion of various projects each of which is aligned to different academic standards. Specific projects may have additional requirements. For example, in order to meet world studies requirements, the students complete a project focused on another country. Within this project, students must answer key questions, compare and contrast the culture, create 5 artifacts, and share a traditional food. Rather than academic grades, student progress is monitored with a skills rubric. Soft skills are first on the rubric as school at JGESA wants to emphasize the development of these important noncognitive skills. Advisors collaborate with one another and the students to evaluate projects. Students earn credit after for their projects once this evaluation signifies that learning targets have been met. Some projects have general guidelines to help the students stay on track and guide project development. For example, World Culture projects must include 5 artifacts that represent the culture, a recipe and sample food, and answers to guiding questions. While students have flexibility in how they meet these guidelines, and may add additional information, they are required	**4**

authentic issues of personal interest to them	to follow this outline. Students are constantly working on their self-driven projects and are given a large amount of responsibility. These projects are often independent, although they may also work in groups. The advisor as well as paraprofessionals work to ensure students are assisted as needed. Students can also pursue additional learning topics by creating and joining clubs. The clubs are student run and meet during the scheduled school days. Because the school does not offer traditional electives, students have created band, choir, and spanish clubs. The Spanish club uses a traditional textbook, Duolingo, and experienced students to guide other students' introduction to Spanish. This structure supports students in developing the skills necessary for self-directed learning while also exposing them to new subjects. Students often demonstrate their understanding by teaching other students about their project. One student works at a fish lab at the University of Minnesota and brought this learning back to JGESA by teaching his fellow classmates how to dissect fish. At his previous school, although he was a straight-A student, the teachers thought he had ADD. At JGESA he has excelled through the hands-on learning. Another student who was interested in fly fishing, learned to tie his own flies. He then led a seminar where he taught other interested students his new skill. Every day students have activity time where students can participate in sports in the gym, outside, or go for a hike (unless it's below -10). They sometime swim or fish when its warm. Student run clubs meet for an hour during the day which allows the students additional time to develop new interests and friends. As long as students can connect their projects with learning targets and academic standards, they have an open-ended selection of project topics. This allows them to pursue learning about a large variety of topics based on personal interest including: ● A student's mom has Stage 4 breast Cancer and is interested in alternative medicine. The student completed a project based on one of her treatments, the Gerson Therapy. ● A student interested in mechanical engineering taught himself Pascal's Law and then created a hydraulic crane. ● A student interested in mechanics rebuilt the transmission of his truck and then printed a 3D model of the transmission to help others understand the process. ● A student who went on a family trip to Prague, created a project about his trip and shared this for World Culture day. ● A student who is interested in videography created a music video complete with drone footage of the campus. ● A student interested in mythology, designed a project about Norse mythology and built a model of an axe. He crafted the handle from wood and then used a 3D printer to create the head of the axe. Students plan and complete their projects with the guidance of their advisor. They use Project Foundry software to help plan and track their progress. They must record their work on a daily basis. Because students typically have non-specific due dates, they must prioritize their time and engage in self-directed learning.	
Support students as they define specific learning goals and objectives		

5) Problem-, Issue-, Community-based investigations encourages active involvement in a civil society (service learning opportunities)		
Provide students with opportunities to investigate real-world community problems and issues **Encourage use of higher-level thinking and creative problem-solving skills to achieve comprehensive understanding of the complexity of real-world problems and issues involving the interaction of their natural surroundings with diverse cultural, economic, and political perspectives and interests** **Support students as they undertake and monitor service-learning activities** **Require students to reflect on their service-learning activities and communicate their findings to classmates, teachers and other appropriate audiences both inside and outside of their community**	For various projects, staff aid students in making the necessary connections to secure funds, services, and resources. For example, for the prairie restoration project, students learned to write grants to secure funds. They also formed partnerships with True Friends, Minnesota Native Landscapes, and the U.S. Fish and Wildlife Private Lands Program. Students have frequent opportunities to get out of the classroom on educational field trips. The school van fits one adult driver and nine kids. Students who are interested in the topic participate in the field trip where they apply their classroom skills to understand and solve real-world problems in the surrounding community. Examples of some of these trips include: ● Prairie restoration project: Collaborated with 3 Rivers Park District, collect seeds, learn about reintroduction of species ● Visited Como Zoo to learn about art from Ocean trash “Washed Ashore” ● Focus on aquatic management: visited hatchery in Genoa WI, camped and the went to upper Mississippi wildlife refuge Multiple times each year, JGESA students engage in community presentation nights where they synthesize findings from their student projects and communicate these findings with various stakeholders. Twice each school year, students do not come to school and instead participate in Experience Day where they join a community member for a day of work.	**4**

6) Using Natural and Community settings, the local environment, as a context for learning		
Uses local natural and community settings as a context for standards-based instructions **Develops students' understanding of natural and socio-cultural systems** **Incorporates the community's cultural characteristics** **Offers students opportunities to apply skills and knowledge in local settings** **Ensure necessary program funds, services and resources, and have a strategy that will sustain program activities**	Instructors and students use the campus to explore and drive the focus of students' projects. Campus features include a lake, fishing piers, hiking trails, a pool, a high ropes course, a rookery and a viewing platform. As discoveries are made on campus, they are incorporated into the student's learning. In spring of 2018, students found an eagle's nest located on the other side of campus. In May, students collected bones and made observations about their findings. The following September, students revisited the nest and collected more bones. They cleaned and examined the bones and looked for evidence of what the birds eat. Additionally, they compared bones and tried to put them together like a puzzle. Because JGESA does not offer electives in the traditional sense, staff members work closely with students to connect them with community members with expertise in various topics. Some of these community members come in to hold guest seminars or workshops. For various projects, staff aid students in making the necessary connections to secure funds, services, and resources. For example, for the prairie restoration project, students learned to write grants to secure funds. They also formed partnerships with True Friends, Minnesota Native Landscapes, and the U.S. Fish and Wildlife Private Lands Program. The students are currently working on a prairie restoration project. They are converting local abandoned farmland into a native prairie. The students wrote a grant to secure funding and will use this money to purchase over 600 plants for the restoration. They will then monitor the area. Through this project they have learned about pollinators, native prairies, field monitoring, grant writing and project planning. The self-directed projects allow students to examine various aspects of relevant culture. For example, within the topic of world culture, some students chose to focus on culture not related to a specific country such as the LGBTQ community, which was of personal significance to the student.	**4**
School name & location: **Date & time of observation:**	**Northern Lights Community School; Warba, MN** 9/11/18 11:45-12:45 3/25/19 9:00-11:00	
Overview of School	Northern Lights Community School is directed by Mike Hamernick. The school opened in 2005 and has been serving students in grades 6-12 for 13 years. Sixty-two percent of the student body is on free and reduced lunch and 48% have IEPs. They follow a hybrid schedule with time for projects (both individual and group/advisory), math (determined by grade and current progress), silent reading time, and seminars. Students choose two seminars to attend per quarter. These seminars range in topics from Harry Potter to Computer Programming to Phenology. Teachers lead the seminars based on their interests and	

<table>
<tr><td></td><td colspan="2">certifications as well as students' interests. All seminars are aligned to Minnesota Academic Standards and students choose the topics they are most interested in as well as those that will help fulfill their graduation credits. Students need 36 credits to graduate. A seminar is worth .4 credits in its aligned subject. Upon graduation, most students attend local community colleges.

Vision and goals
1. Every student will be treated as a unique individual and will each have a Personalized Learning Plan (PLP).
2. Every student will be ensured a safe family-oriented learning environment that focuses on continual growth.
3. Every student will learn to be environmental stewards community service oriented citizens.
4. Every student will acquire essential life skills to ensure success in the 21st century.
5. Every student will learn through authentic hands-on projects.
6. Every student will have autonomy over their education as they drive toward mastery.</td></tr>
<tr><td></td><td colspan="2">1-Rarely Uses 2-Occasionally Uses 3-Often Uses 4-Consistently Uses</td></tr>
<tr><td colspan="3">1) Integrated interdisciplinary instruction used to teach academic content standards</td></tr>
<tr><td>Provide students with the opportunities to explore connections between subject area disciplines and among natural and social systems

Coordinate students' learning between subject areas and class periods

Cross traditional disciplinary boundaries to develop comprehensive understanding of natural and socio-cultural systems

Create a continuum of learning that crosses grade levels and allows students to conduct multi-year research</td><td>Students typically have time in the morning to work on advisor led projects and in the afternoon, they work on their own individual projects. However as one advisor explained, this is a system based on fluctuation and flexibility to adjust to students' needs.

Last quarter, one advisory completed a project centered on water. With the help of their advisor, the students wrote two grants in order to purchase and install a water filtering station for the school. They designed reusable water bottles and sold them as a fundraiser. Then, using the data provided by the filter, they began a water monitoring project where they identify how many bottles of water are conserved each day. As a way to further educate the rest of the school and community, they then compiled student-created resources that would educate others about water. Each student played a role in the project and contributed based on their interests and skills. Some of the components include:
• A student who is interested in technology created a flip book with pixelated pictures showing the amount of water in the human body
• Monitored how long the average drink at the water fountain takes and then calculated the average water consumption
• Created fake waste samples to educate others on symptoms of dehydration
• Created an art piece depicting the future of the world if water consumption stays at its current level
• Created a book about the history of bottled water
• Constructed a poster to educate others about the amount of water consumed through daily activities and various ways to conserve water</td><td>4</td></tr>
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<tr><td>and service learning projects that contribute to their community</td><td>They tied the project into their Christmas door decorating project and each student created mini trees and fish out of old water bottles
As a final piece, the students created a music video to the song “Imagine” and changed the lyrics to center around a future world without water
Other examples of interdisciplinary learning include:
Students create an annual haunted house and open it to the community as a fundraiser. Participating in the project is one way students can earn credits towards art while thinking critically and collaborating with other students.
Students at Northern Lights participate in the program Trout in the Classroom. They grow local species of trout in their classroom, feed them, monitor the water, and then release them in designated areas to help restock native populations.
As an option for math senior year, students may take a life skills class that involves balancing a checkbook, filing taxes, and paying for college.
Archaeological dig combining history and science
Winter survival: Built quinzhees, learned science of fire, built fires and shelters with tarps, earned extra points for building shelters appropriate for the rind direction
Wild West: Learned about the history of westward expansion, reenacted various scenes, drew sketches of bank robbers
Learning about gardening through the greenhouse</td><td></td></tr>
<tr><td colspan="3">**2)** Combination of **independent & cooperative learning**</td></tr>
<tr><td>Facilitate students as they form teams to work on projects and investigations</td><td rowspan="3">Students must complete both individual projects as well as advisor led projects. During advisor led projects they determine how they would like to contribute based on their individual interests and strengths. The complete their math work independently and can therefore work ahead or complete review rather than work at the average pace of other students.</td><td rowspan="3">3</td></tr>
<tr><td>Ensure that student teams include a wide range of learning styles and ability levels</td></tr>
<tr><td>Help students develop group membership skills</td></tr>
<tr><td colspan="3">3) **Collaborative instruction** connects teachers, parents, students and community members</td></tr>
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Involve students and community members in planning and instructional delivery Provide opportunities for teachers to model positive team relationships Allow teachers to have regularly scheduled team meetings	Students collaborated with the community to learn about land-use and grant writing to create a disc golf course on the school property. While discussing the advisory set-up with one of the advisors, she explained how she doesn't just pick topics she is excited about. Instead she thinks about the skills her students will need to succeed once they are outside of the school walls. Although this her 19th year in education, this often means that she has to learn alongside her students. She also explained that sometimes she starts something and then realizes it isn't working for the students so they will throw it out and find a new direction that better meets student needs.	3-Although students and community members are highly involved, staff appears to operate in their own spheres of interest rather than fully collaboratin g.
4) Learner-centered, constructivist approach		
Take into account students' individual learning styles, multiple intelligences and cultural background to ensure effective instructional design practices in the context of the local community Assist students as they initiate self-directed courses of study Allow students to construct their own understandings Provide students with opportunities to pursue authentic issues of personal	Each advisory has a licensed teacher as well as a paraprofessional to help assist students in their course of study. They also employ a full time social worker to assist students in social-emotional learning and development. Teachers primarily use rubrics, portfolios, and completed projects to determine students' skills mastery. Students are required to present their projects at community presentation nights. This helps student gain confidence when talking to large groups and it helps engage the community in the successes of the school. Projects begin with brainstorming and a mind map of ideas. Once students have a clear idea of their project interests, they use Project Foundry software to outline their ideas, align projects to state standards, and track progress. They work closely with their advisor to ensure they are making progress towards completion. Students may pursue authentic issues of personal interest by joining clubs, which meet during school hours on Fridays, choosing specific seminars, and exploring topics through independent projects. They also have a choice in how they demonstrate their knowledge and contribute to the advisory projects. In order to better understand her students, one teacher has students create about me flip flops at the beginning of the year. She gives them a rubric to help them immediately understand her expectation. They must use technology to resize the information on the flip flop and then give a speech to the class. This helps students develop a greater level of comfort when speaking in front of a new group, helps them build community, and helps the advisor learn more about the individual learning styles of each student.	4-Students needs are the focus of the school. They are given many forms of support to help develop life skills and build upon existing knowledge in order to develop lifelong learning skills and

interest to them Support students as they define specific learning goals and objectives	In order to support students in their progress towards success beyond high school they must complete a checklist of life skills before graduation. This includes preparing their graduation speech, completing their portfolio, creating a resume, and uploading a profile to apply for financial aid. Students work with a variety of staff to develop skills and ensure completion of the checklist.	meet graduation requirements.
5) Problem-, Issue-, Community-based investigations encourages active involvement in a civil society (service learning opportunities)		
Provide students with opportunities to investigate real-world community problems and issues Encourage use of higher-level thinking and creative problem-solving skills to achieve comprehensive understanding of the complexity of real-world problems and issues involving the interaction of their natural surroundings with diverse cultural, economic, and political perspectives and interests Support students as they undertake and monitor service-learning activities Require students to reflect on their service-learning activities and communicate their findings to classmates, teachers and other appropriate audiences both inside and outside of their community	Seniors must include a community service component in their projects. Each student must also create a senior capstone that includes reflection on their years in school and a short speech to give at graduation. In order to receive credit for a project, students must present their findings, either at a presentation night or to the class. They must also meet with their advisor to ensure they have met all standards. This spring, one advisory group is moving into a unit about energy. The school has solar panels but most of the school community doesn't know how to read the data collected. This unit will help them better understand this information and make more informed decisions in the future. To begin the unit, they tested different appliance and completed energy conversions to better understand utility bills. They've learned about the different between AC and DC as well alternative forms of energy. At the end of the unit they will have a choice in a hands-on experience where they can create a mini-wind farm or a solar operated oven. They will be comparing green energy to more common types of energy based on fossil fuels. A board members has a house that is completely off-grid and the student toured his house to learn about upfront costs, long term savings, and other factors that impact solar energy.	4

6) Using Natural and Community settings, the local environment, as a context for learning		
Uses local natural and community settings as a context for standards-based instructions Develops students' understanding of natural and socio-cultural systems Incorporates the community's cultural characteristics Offers students opportunities to apply skills and knowledge in local settings	NLCS uses the local context as a grounding spot for many projects, seminars and learning explorations. Many of these are explained in greater detail above. For example, they have created a community garden, a greenhouse, rainwater runoff collections systems, and a nectar garden using native plants and recycled bowling balls. The students track the energy output of the schools' solar panel and manage the food waste and composting program (see #5 for more details). Students may choose local topics of community interest to focus on for their projects. For example, last year some students collaborated with the city to create a Frisbee golf course on the school campus. This year a group of students is advocating and lobbying for the Green New Deal in Minnesota. Students participate in the Trout in the Classroom program (see #1 for more details).	4

School name & location: **Date & time of observation:**	**Northern Waters Environmental School; Hayward,WI** 10/2/18 8:10-10:30 3/27/19 9:30-11:30
General Notes	Northern Waters Environmental Schools is an environmentally-focused charter school in the Hayward Public Schools District. The school serves approximately 40 students and has been open for 7 years. Students complete one independent learning project (ILP) per semester. They design projects that meet credit requirement through topics they are interested in. Students earn math credit through the online program ALEKS. They work at their own pace through individual or small group work. They can choose to complete one class per year or work at an accelerated pace to complete additional classes. Advisors lead a seminar each semester which is focused on a central environmental theme. Advisories are divided into middle and high school. Approximately once per week, students participate in a field day where they work on projects in the community or learn about their local environment. The field days occur through a partnership with the WI Green Schools Network and give students an opportunity to apply their learning and create meaning beyond themselves. Additionally, students may choose to take up to two classes at the traditional public high school which allows them to dive deeper into special areas of interest, such as art, band or foreign language, that the charter school may not have the resources to facilitate. The school includes a library with couches, a learning lab for messier projects, one classroom for each advisory and a large

	room for collaborating. In this space, a kitchen houses cabinets, a sink, microwave, and fridge. Student are allowed to store snacks and lunches here and I often saw them grabbing a snack in between work breaks. The hallway has space for hooks and gear, while open space around the building houses extra outdoor gear for students who may not have the resources to buy their own.	
	1-Rarely Uses **2-Occasionally Uses** **3-Often Uses** **4-Consistently Uses**	
1) **Integrated interdisciplinary instruction** used to teach **academic content standards**		
Provide students with the opportunities to explore connections between subject area disciplines and among natural and social systems Coordinate students' learning between subject areas and class periods Cross traditional disciplinary boundaries to develop comprehensive understanding of natural and socio-cultural systems Create a continuum of learning that crosses grade levels and allows students to conduct multi-year research and service learning projects that contribute to their community	Students initiate their own project each semester. They have access to binders which include all of the WI state academic standards. They must work independently or with teacher assistant to ensure their project meets the necessary standards. Within these constraints, they can explore any topic of interest. Examples of student-led interdisciplinary projects: ● Prairie Project: created a prairie, purchased seeds, built benches, designed butterfly boxes ● Evolution of baseball ● Jerky production ● How can I find comfortable seating for kids at NWES? ○ Priced out various options ○ Tested students' reactions ○ Created a new flip out couch by sewing various cushions together ● Fishing lures: tested various types of lures and then took them to different lakes to see which fish like each type of lure best Students also participate in seminar, which is a teacher led learning experience centered on an environmental theme (see #5 for more details)	**4**
2) Combination of **independent & cooperative learning**		
Facilitate students as they form teams to work on projects and investigations	Students use the fish bowl method to collaborate with one another when they are stuck on their projects. They sit with other students and share their ideas and struggles in order to brainstorm new solutions.	**3**

Ensure that student teams include a wide range of learning styles and ability levels Help students develop group membership skills	Students work on both independent and group projects. Through seminar, they work on their assigned portion of a teacher-led project. Field days often require group collaboration and teamwork. Student led projects are typically independent, although students may collaborate towards a larger topic. For example, two middle school students were interested in how video games impacted their health. One student focused on the heart rate and the other focused on how it impacts the brain. They compiled their research to share data together. Field experiences also bring the students together to develop cooperative learning skills. They go winter camping and elk bugling together. This year the weather was really bad so they slept in a church but last year all of their tents got flooded. Experiences like this challenge the students to rely upon one another.	
3) **Collaborative instruction** connects teachers, parents, students and community members		
Involve students and community members in planning and instructional delivery Provide opportunities for teachers to model positive team relationships Allow teachers to have regularly scheduled team meetings	Students begin the week with an advisory meeting that often includes icebreakers, team building activities, and sharing highs and lows from the weekend to help foster a sense of community. Due to some staffing changes, the students have new advisors this year which has changed a few things. However, the staff often asks for student input and allows them to vote on things like field day schedule changes. Advisors help students make connections with community members. For example, one of the board members is a doctor. He aided the students investigating video games by offering expertise and equipment. One student said that his understanding of community has greatly expanded through this program. “It can be as small as a room or as big as the universe.” The students have Personalized Learning Days where they can work at school, home or out in the community. One student went to the community center and played basketball, then came to school and did some work and then volunteered at the Humane Society. Other students use the time to work at their job. They use a computer program to sign in and out and let the teachers know what they’re doing and where they’re at. They have to earn this. On Tuesdays, they decide what they’re going to do and where and then the teachers, student, and parents have to sign the agreement. They have to meet their goals to have the freedom. About once a month they have work from home days on the days the traditional school has half days. They can work at home but they have to do math, reading and their ILP. They’ll have to visit the school board with their test scores to show that they aren’t falling behind and then gain approval for next year. In addition to giving the students freedom it also gives the teachers more time to prep and collaborate. Because the teachers are with the students all day they don’t have many breaks on the other days.	**4**
4) Learner-centered, constructivist approach		

<table>
<tr><td>Take into account students' individual learning styles, multiple intelligences and cultural background to ensure effective instructional design practices in the context of the local community

Assist students as they initiate self-directed courses of study

Allow students to construct their own understandings

Provide students with opportunities to pursue authentic issues of personal interest to them

Support students as they define specific learning goals and objectives</td><td>Each advisory is centered around a classroom economy. The students each have a class job for which they earn a paycheck. If they complete the job every day, they will have just enough to cover their desk "rent" and taxes. However, they can take on additional responsibility to earn extra money to buy things such as music privileges during independent work time or snacks from the school store.

The local Ojibwe culture is evidenced through student paintings and dual language signs with both English and Ojibwe words. A white board in the common room includes important Ojibwe phrases as well as a pronunciation guide.

Examples of student-led projects:
● Green architecture
● Interior design
● How video games impact vitals: Took blood pressure before and while playing fortnight. While doing research, learned that there are specific games to assist older people in improving their memories.
● Studying the history of the Hayward H.S. coaches and creating plaques about them for the high school hallways

Each year in spring the students attend the Youth Summit and Envirothon. Students can choose to display an environmentally-focused project or compete in Envirothon. Envirothon involves tests in four content areas: soil, forest, aquatic/land, and wildlife. The students are also given a team issue ahead of time and they then have to present a solution to the team topic. This year they are farm owners and have 400 cows, soybeans, hay, and streams with blue-green algae. Within this context, the students have to come up with a course of action and present to a panel. In order to review for Envirothon, each student created their own online quiz using the Kahoot program. Each student led the other team members through the review, while the EE specialist stopped progress to address points of confusion. Rather than giving students the answer, she guided them using questions such as:
● "Pause, that was confusing to me. Why was it confusing to you?"
● "Can you explain your thinking?"
● "Explain why you thought it was the other answer"</td><td>4</td></tr>
<tr><td colspan="3">5) Problem-, Issue-, Community-based investigations encourages active involvement in a civil society (service learning opportunities)</td></tr>
<tr><td>Provide students with opportunities to investigate real-world community problems and issues

Encourage use of higher-level thinking and creative problem-solving skills to</td><td>On Tuesdays, the students study the local phenology and record their observations in field journals.
In addition to independent projects, students participate in seminars, which are advisor led projects. The advisors choose a theme for the year and then divide the theme into topic focuses for each quarter. These investigations incorporate interdisciplinary, problem-based learning and are often focused on the local community. Below is an outline of the middle school seminar this year.

Overarching theme: How are resources distributed globally?
Q1: Natural Resources</td><td>4</td></tr>
</table>

achieve comprehensive understanding of the complexity of real-world problems and issues involving the interaction of their natural surroundings with diverse cultural, economic, and political perspectives and interests Support students as they undertake and monitor service-learning activities Require students to reflect on their service-learning activities and communicate their findings to classmates, teachers and other appropriate audiences both inside and outside of their community	Big Idea: Humans depend on the earth's limited resources to get what they need. Resources can be renewable or nonrenewable. Unequal distribution of resources creates inequities between regions. Project Focus: What does our clothing say about us? Clothing is made from resources. Clothing manufacturing is a controversial issue. Fast Fashion has costs. Next Steps: How can we support safe, sustainable, and ethical clothing options? Q2: Money Big Idea: Limited money impacts people's choices Project Focus: How can we raise money for an outdoor learning space? Next Steps: What are ways to earn a higher profit margins or get donations/grants? Q3: Food Big Idea: Access to types and quantity of food impacts our life Project Focus: How can we make the school lunch experience better? Next Steps: TBD (currently fourth quarter) Q4: Land Big Idea: How can we use competing designs to plan a salsa garden? The details for this month have not been fully planned. However, after learning about resources from a more global perspective, this last quarter will focus on the land around school. Students will be improving the school gardening space and harvesting vegetables to make homemade salsa. They will work in field teams to compare various methods of pesticide control and will earn additional points for sustainable design.	
	6) Using Natural and Community settings, the local environment, as a context for learning	
Uses local natural and community settings as a context for standards-based instructions Develops students' understanding of natural and socio-cultural systems Incorporates the community's cultural characteristics	Field days take the students out of the classroom walls and into the local environment. In the fall, they participated in a fall colors hike and each student contributed items to make a group trail mix. They work with a field biologist who previously worked for the DNR. This spring they are learning about the ethical harvesting of maple syrup and have been visiting the local sugar bush to collect sap. They need to connect each project to sustainability and community impact questions. The students raise native brown trout in the classroom and they will restock these trout in a local lake. Students are in charge of maintaining the aquarium and a few of them painted a background for the tank.	**4**

Offers students opportunities to apply skills and knowledge in local settings	The students participate in a yearly survival day where they apply the field skills learned throughout the year. On Survival day, they think they're going somewhere but then the bus breaks down. They have to build a shelter, trade, create a fire, and make food. They earn strategy points and the food is judged. They work with GPS and compass skills. They're also evaluated on their team work which can help win advantages like a tarp or other supplies.	

Appendix E-Correlation Analysis

Table 8

Correlations between need satisfaction and RAI

	RAI	Post Autonomy Satisfaction	Post Relatedness Satisfaction
Post Autonomy Satisfaction	.38*		
Post Relatedness Satisfaction	.38*	.41*	
Post Competence Satisfaction	.38*	.51*	.44*

*p<.01

Table 9

Correlations between need frustration and RAI

	RAI	Post Autonomy Frustration	Post Relatedness Frustration
Post Autonomy Frustration	-.45*		
Post Relatedness Frustration	-.20	.20	
Post Competence Frustration	-.23	.24	.36*

*p<.01